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NEW YORK CENTRAL TERMINAL IMPROVEMENTS.

As an engineering undertaking the passenger terminal of the New York Central lines, described in this issue, ranks among the largest of the present day. Certain phases of the design and construction are particularly worthy of mention. The use of electricity as motive power has made it possible to depress the tracks below the surface, the entire system of tracks and yards being placed below the street level and a number of intersecting streets being thereby restored to the public. Upon the area above the yards—twenty city blocks, containing about 46 acres—will be erected buildings which will undoubtedly, in time, yield to the company a very large interest on the capital invested. The railway company will exercise strict supervision in regard to the architectural features of the buildings, and if present plans are carried out this most distinctive phase of the development promises to be of much importance to the city of New York.

The most noteworthy feature of the terminal—or, more properly, terminals—is the complete segregation of incoming and outgoing traffic, separate buildings being provided for each class. In the main building, for outbound traffic, local and through travelers are kept on separate levels—an arrangement which naturally increases the capacity of the terminal in a very marked degree and also adds to the comfort of the traveling public. For traction purposes energy is received from a generating station previously described in these columns, and for the terminal and other buildings erected over the track area a service plant has been installed. Ample space has been provided for future enlargement of this plant as new buildings are erected, with consequent increase in load requirements. It is to be noted that the two chimneys of this plant have the exclusive privilege of pouring smoke over this restricted district.

REGULATION OF INDUSTRIAL CORPORATIONS.

Secretary Nagel of the Department of Commerce and Labor is not to be numbered among those progressives who spell the name of their doctrine with a capital P. This is evident from the comments the Secretary makes in his annual report, submitted this week, on the proposal to create a federal industrial commission. If such a commission is created, Mr. Nagel does not believe that it should have powers over industrial corporations equal to those exercised by the Interstate Commerce Commission over railways. In particular he opposes the suggestion (somewhat tentatively put forth by at least two members of the present administration) that the proposed industrial commission shall have power to fix the prices at which commodities may be sold. Not the maximum of control, but an effort "to preserve, to the greatest extent consistent

with the public welfare, the element of self-regulation," should be the aim of federal regulation, the Secretary believes. He favors the establishment of principles of conduct which would impose desired restraints and at the same time leave "a wide field for individual achievement."

There is some comfort in these views for those who have wondered what incentive for individual achievement will be left after we are all properly regulated according to the most radical notions of the day. There is comfort also for those who, while not opposing regulation of monopolies and great combinations, are fearful that federal control of industry, once begun, will not stop short of fixing prices. We have seen how the desire to eliminate railway abuses has grown into an appetite for fixing rates and controlling almost every essential of management. Similarly, the intent to do away with the evils of monopoly, or what amounts to it, may develop into a demand that some governmental agency fix the price at which products of mine, farm and factory may be sold. Is this desirable or necessary to the proper control of combined capital? Secretary Nagel's words are an invitation to think before we go further into the labyrinth of federal industrial regulation.

GOVERNMENT REGULATION OF WATER-POWERS.

The recently published annual report of Secretary of the Interior Walter L. Fisher deals at some length with questions of water-power policy. Congress, controlling streams upon the public domain and navigable streams in general, should be in position to carry out a well-defined and comprehensive policy with regard to permitting development on the streams within its control. We have at various times discussed the supposititious water-power trust in its relations to government policy and have pointed out that the particular ownership of a water-power or group of water-powers is of no particular interest to the consumer. It is of interest to him that the government should make such provisions as, first, will encourage instead of discouraging the development of powers, and, second, will cause them to be developed under such regulations as shall prevent robbing the consumer through unwarrantably high prices. These two functions the government can well assume.

So far as prices for electrical energy are concerned, the utilization of water-power is in the same condition as any other regulated public monopoly. The acceptance of suitable regulation is now commonplace and no particular objection is made to it. The vital question which arises is whether the necessary control of the water-powers can best be exercised by the federal government or by the states. Experience in many other matters related to general policy indicates very clearly that federal control is the only means by which a consistent policy of encouraging development and discouraging extortion can be carried out. Within limits, the states do effective work in local matters, but they have no well-defined mutual responsibilities, and in these days of long-distance transmission the utilization of water-powers becomes an interstate affair. A consistent policy requires for its carrying out the action of the general government so that advance cannot be retarded by discrepancy between state regulations or by the control of state governments by big industrial combinations, a condition which is only too familiar at the present time. The dread of Uncle Sam's long reach and heavy hand is a far more potent inspiration to square dealing than the discussions in a dozen wrangling legislatures, sometimes of none too savory reputation as to motives.

It is of vital importance to secure the passage of such laws by Congress as will give the general government adequate control in hydraulic enterprises on the public domain and in the interstate relation arising therefrom. Such legislation should be urged upon Congress by all who have the economic interests of the country at heart. The new administration comes into power with such a backing of popular and congressional support as has scarcely been known in the history of the country. It will have a power of doing things effectively which it would be hard to match anywhere in the world, and its opportunities for usefulness are therefore extraordinarily great. The matter of control of water-powers is by no means the least important of the questions which confront it. What American industry wants is a cheap and bountiful power supply, a stoppage of the enormous waste which is now going on, and encouragement to legitimate enterprises for utilizing it.

THE RELATIVE EFFICIENCY OF "EARTHS" IN RADIO-TELEGRAPHY.

It is always interesting to find experimental confirmation of well-accepted principles extended in new directions. A little more than a year ago Prof. Charles A. Culver described in our columns some of his experiments on various methods of grounding receiving antennas in radio-telegraph stations. On page 1319 of this issue he presents the results of a somewhat similar investigation, applied, however, to the radiating or transmitting station. To what might be considered a remarkable degree it is found that the arrangements which make good absorbers also prove to be good radiators, in accordance with Prévost's theory of exchanges. Nevertheless, the contradictory departure from symmetrical results at both points when the earth connection is formed from several wires is especially worthy of note. Much more information of the sort that Professor Culver presents is necessary before we can hope to appreciate fully the function of the earth in radio-transmission. A very considerable amount of work along these lines has already been accomplished, but the number of variable qualities involved is so large that it is only through masses of experimental results that we may expect to confirm existing theories or to establish new ones.

In studying Professor Culver's paper it will be noted that his standard earth connection bears a closer resemblance to a wire telegraph "ground" than to the sort of distributed wave-chute normally used in radio-signaling. Nevertheless, when matters of altered current density and wave-front distortion and the consequent changes in radiation factor and total antenna circuit resistance are properly compensated for, the two cases become very closely analogous. It is quite generally realized that true radiation does not commence until the field energy about a transmitting antenna has passed one-quarter of a wave-length from

it. The magnetic and static forces within that region are in effect chained to the sending station and must continue to rush back and forth from the vertical wire, whipping off a certain percentage of energy each time they reach the limit of the quarter-wave zone. Since the induced fluxes near the transmitter have linked with them large currents set up in whatever conductors they encounter, there is manifestly opportunity for losses of energy in the ground immediately surrounding a sending station. It would seem reasonable to expect that when the earth's surface in the direction of a receiving station is made highly conductive by stringing wires along it the losses in that part of the generally emitted wave will be reduced and the effect upon the receiver heightened. This is one of the points that Professor Culver's work seems to confirm in actual practice. It is to be hoped that a great deal more will be done along these lines, using extended ground connections and longer wave-lengths and including determinations of total antenna resistance and radiation factor for each set of conditions.

STUDIES IN THE PHOTOMETRY OF LIGHTS OF DIFFERENT COLORS.

It is a fact familiar to photometrists that whereas the judgments of different trained observers are likely to agree as to the relative candle-powers of two different steady and stationary lamps of the same color compared in a photometer, yet their judgments are not likely to agree when the two lamps compared differ materially in color. This fact first became apparent many years ago when gas flames were compared for candle-power with electric arc lamps by means of the wedge photometer or the Bunsen grease-spot photometer. It is not possible for two disputing photometrists comparing heterochrome light sources to select a third for arbiter, as is done in matters of equity disputes and arbitration proceedings, because, whereas any competent unbiased arbiter represents the norm by which error due to mental prejudice may be eliminated, the arbiter photometrist, however free from prejudice, is also likely to err in his judgments. In heterochrome photometry we are all more or less blind.

The reasons for the remarkable uncertainty and indefiniteness in the comparison of heterochrome illuminations are not yet beyond dispute, but it is generally believed that we have three separate and distinct organs of color sense located in the retina of the eye, so that when, for example, a red light is compared with a blue light the mind has to estimate the relative intensities of two independent sensations; or, to use an exaggerated illustration, to compare the intensity of a smell with the intensity of a taste. When, however, lights of the same color are being compared side by side, the mind has only to estimate the relative intensities of sensations of the same sense. It has been known for some time that when the two heterochrome illuminations to be compared are impressed on the retina in brief impulses as flickering illuminations, two effects are capable of being produced. That is, first, the difference in color disappears, or the colors of the two illuminations fade into a common neutral tint, and, second, with the disappearance of color contrast the precision of comparison pertaining to monochrome photometry reappears. In other words, it is found that different observers using the flicker photometer on lights of different colors are able to agree in their comparisons within about the same limits of discrepancy as when lights of the same color are compared in the ordinary way. Nevertheless, the comparisons of heterochrome lights obtained by means of the flicker photometer have been felt not to be the same as should be obtained by a normal eye capable of comparing two different colors without any confusion of sense. The flicker photometer gave a definite and a reproducible comparison, say between a carbon and a tungsten lamp, but not a true comparison of their candle-powers.

A series of papers on heterochrome photometry and the flicker photometer, as alluded to in this week's *Digest*, has recently been published by Dr. Herbert E. Ives in the *Philosophical Magazine*. These papers contain the results of some interesting researches on heterochrome photometry made in the laboratory, which tend to show that the flicker photometer is not only much superior to the non-flicker photometer in dealing with lights of different colors but that it enables a correct estimate of luminous flux of any color to be obtained within the limits of error of monochrome photometry. The important result is announced that once the normal spectrum luminosity curve has been obtained experimentally for each observer, his flicker-photometer measurements become quantitatively reliable as soon as the spectrum of the lights compared is known. Expressing the same result in another way, the flicker-photometer effect of any given intensity of luminous flux can be predicted when the spectrum distribution of that flux and the luminosity sensibility curve of the observer's eye are known.

Incidentally, the results as published indicate that the eyes of different observers differ very appreciably in their visual sensibilities at different points of the spectrum as determined by the flicker photometer, so that although only a small percentage of persons may be so divergent from the general mean of color perception as properly to be called color-blind, yet a large percentage are sufficiently divergent to be classed as abnormal, and their degree of abnormality may be definitely assigned for each point of the spectrum with reasonable precision. This requires, of course, that a large number of persons shall have been examined flicker-photometrically, in order to arrive at the mean or general average curve of visual sensibility. Perhaps this average varies from race to race of men and from age to age of the world. It is admitted to vary distinctly at different ages of one and the same individual.

Hope is held out in the article that an artificial eye may be capable of being constructed and developed on photo-electric principles so screened and adjusted that the quantitative relations of luminous radiation falling upon it, as revealed say by a suitable galvanometer, may accurately correspond to the optical behavior of the mean normal human eye. Assuming that such a piece of apparatus could be perfected and maintained indefinitely, it would thus become possible to lay upon the shelf of a museum a model inorganic eye which should serve as a standard of reference of visual sensibilities which could then be expressed in known units.

CHICAGO TRACTION SITUATION.

(*By Telegraph.*)

Negotiations have been resumed between the city authorities and the surface and elevated railway companies of Chicago having for their object the merger of all the traction interests of the city, or at least a working arrangement for universal service, with transfers between surface and elevated lines and with subways, when built, on the "one city one fare" principle. The present plan contemplates the removal of the elevated railway union loop after the building of a downtown subway. At conferences held this week a more harmonious spirit has been exhibited by the Mayor and the Aldermen on the one hand and the companies' officers and lawyers on the other. One stumbling block heretofore has been the difficulty of fixing a fair valuation of the elevated railway companies' property. Mayor Harrison has signified a willingness to discuss a valuation based on outstanding bonds plus the cost to the present owners. The elevated railway companies fix this figure at about $86,000,000, of which $36,000,000 is the total underlying debt.

A. I. E. E. AFFAIRS.

At a meeting of the board of directors of the American Institute of Electrical Engineers on Dec. 13 authority was granted for the organization of an Institute branch at the University of Washington, Seattle, Wash., thus bringing the number of University branches up to forty-six.

A request from the Pittsfield Section that an Institute meeting should be held in Pittsfield, Mass., in May, 1913, was laid over until the meetings and papers committee could obtain further information.

A discussion upon the general subject of technical committees of the Institute, with more particular reference to the appointment of additional committees for special fields of electrical engineering activity, resulted in the passage of a resolution authorizing President Mershon to appoint a special committee to make a study of the entire subject of technical committees, some question having arisen as to the relative advisability of handling additional lines of work through new committees or through sub-committees of the existing technical committees.

President Mershon asked for the views of the board in regard to the desirability of the Institute's taking up the subject of depreciation of electrical apparatus and machinery and the allied subjects of amortization, going value, etc. There was much discussion on this question, which was considered of such importance that the president was authorized, in appointing the special committee to study the work of technical committees, to refer to that committee the question of broadening the scope of the work of the Institute and the character and type of the papers to be presented.

The electric lighting committee reported upon the Illuminating Engineering Society's primer on "Light," the circulation of which the Institute had been asked to extend as far as possible. It was decided to give publicity to the primer by a special article to appear in the January *Proceedings*.

Reports were read from the Institute's representatives at the fourth national Conservation Congress, Indianapolis, Ind., Oct. 1-4, 1912, and the American Mining Congress, Spokane, Wash., Nov. 25-28, and a recommendation from the delegation to the Conservation Congress that the Institute appoint a permanent representative upon the congress' advisory board was referred to the Institute's public policy committee.

Upon the recommendation of the board of examiners, 55 applicants were elected associates and 119 students were ordered enrolled. Past-president Henry G. Stott was transferred to the grade of fellow under the regular provisions of the constitution. Eighty-nine associates and eighty-nine members were transferred to the grades of member and fellow respectively, in accordance with the provisions of the special section of the constitution.

PROFIT SHARING BY BROOKLYN EDISON COMPANY.

At a meeting of the directors of the Edison Electric Illuminating Company of Brooklyn held Dec. 16 it was voted to continue the practice now in effect for two years past of sharing the profits of the year with all employees of the company who have been in the service for two years or more. The amount which will be placed to the credit of the Edison employees this year as their share of the profits is in excess of $51,000. Out of the 1800 employees on the payroll of the company, 871 will participate in the profits; 224 of these are two-year men; 141, three-year men; 74, four-year men, and 433, five-year men. To this latter class, representing more than one-fifth of the employees of the company, the profits will amount to approximately full salary for a calendar month. The money is placed in an investment fund conducted by the company for the benefit of the employees, where it pays 6 per cent interest, compounded quarterly. The total credit to employees in the Edison fund is now in excess of $250,000.

PLAN 160,000-HP PLANT FOR MONTREAL.

The National Hydro-Electric Company has taken further steps toward supplying Montreal with power from its proposed plant at Carillon Falls, Quebec. A small plant is already in operation, but it is planned to build a very extensive installation, which Mr. Miles, the president of the company, declares will cost $10,000,000 and will be capable of developing 160,000 hp. Power from the small plant is to be used for the construction of the larger one and also to supply neighboring municipalities. The company has a Dominion charter, enabling business to be done in the Province, and application has now been made to the Provincial Legislature to grant the right of placing poles and wires in municipalities without dealing with each one in particular. The right is also sought to use the Montreal conduits for the company's circuits.

Among the places in which the company asks permission to operate are Assomption, Terrebonne, Two Mountains, Jacques Cartier, Laval, Montcalm, Joliette, Berthier, Richelieu, Missisquoi, Vaudreuil, Argenteuil, Soulanges, Chambly, Chateauguay, Beauharnois, Ottawa, Iberville, St. John and Labelle. The first issue of bonds and debentures is $12,000,000.

ILLUMINATION AND DECORATION.

At a combined meeting of the New York Section of the Illuminating Engineering Society and the Art in Trades Club on Dec. 12 Mr. George Leland Hunter presented a paper entitled "Color, Shade and Texture," in which the dependence of illumination upon decoration was discussed in detail. The author showed that the quality and quantity of light required for interior illumination depend upon the color and texture of the wall and ceilings, and he contended that black walls can never be illuminated. He expressed the opinion that only the human eye is able to judge of the adequacy of the lighting. He said that if a room appears poorly lighted it is poorly lighted, notwithstanding readings that may be obtained upon illumination meters. In order to secure the most satisfactory results for the house owner,

the lighting equipment must be designed in conformity with the plans of the architect and the decorator.

Mr. P. S. Millar called attention to a type of instrument which accomplishes the result desired in determining the adequacy of a lighting equipment. It is a photometer for measuring the brilliancy of an illuminated surface rather than the light incident upon the surface.

Mr. Bassett Jones, Jr., claimed that it is not necessary to waste light in illuminating dark walls. Light walls should be illuminated, but dark walls should be left unlighted. Mr. Jones described in detail a black background for stage purposes which is devoid of reflection. In front of a close-mesh black-cloth screen are placed two black gauze screens which absorb most of the rays directed toward the background and practically all of those reflected from the black cloth screen.

Mr. G. S. Barrows agreed with the author that the lighting requirements should be specified by the architect, but he argued that the lighting equipment should be designed by the illuminating engineer.

Mr. G. Nichols remarked that, by reason of the many details to which he must give attention, the architect is unable to devote sufficient time to the lighting features to insure satisfactory results. What is desired is co-operation between the illuminating engineer and the architect.

Mr. Albert Jackson Marshall claimed that the inability of the illuminating engineer to carry out the desires of the architect is generally the real cause for the unsatisfactory results obtained.

Mr. Norman Macbeth stated that the amount of money expended for lighting equipment is relatively so small that the architect, who receives his pay on a commission basis, can afford to spend only very limited time on the lighting arrangements.

Chairman George H. Stickney announced that at the January meeting of the section a paper entitled "Lighting of the Auditorium of the Armory at Atlanta, Ga.," will be presented by Mr. B. F. Pierce.

Mr. Macbeth, on behalf of the council of the society, stated that steps have been taken to form an illuminating engineering society in Germany, the movement having received the indorsement and co-operation of the government officials.

ELECTRICAL SALESMANSHIP AND EDUCATION.

At the semi-monthly meeting of the New York Jovians, Dec. 18, Statesman Joseph F. Becker reported that eighty-eight new members were initiated at the "rejuvenation" held on Monday of this week. The New York Jovians, he said, now have sufficient funds to carry forward their work with vigor, and several committees are under consideration to take charge of the activities of the order in various directions.

Dr. Samuel Sheldon, professor of electrical engineering at the Brooklyn Polytechnic Institute and past-president of the American Institute of Electrical Engineers, was the only speaker at the meeting, his subject being "Salesmanship and Education."

One of the most interesting parts of Dr. Sheldon's talk was a brief account of the scientific methods of German public education, the purpose of which is to select the work for which a pupil is best fitted and to specialize in this work in "continuation schools" after elementary education is completed. Of 119,000 German salesmen 56 per cent attend continuation schools. In Prussia 89 per cent of all salesmen attend these schools for the purpose of extending their knowledge of the line in which they work. A similar system, Dr. Sheldon said, is needed in the United States, not only to train men but to discover the work for which they are best fitted and to keep them out of overcrowded callings. Dr. Sheldon suggested that the Jovian Order could do a most useful work and accomplish one of the purposes for which it exists by starting a movement for the adoption of methods of education similar to those that have proved so successful in Germany.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA.

At the regular monthly meeting of the Electric Vehicle Association of America held in New York on Dec. 17 a paper entitled "Central-Station Influence on the Electric-Vehicle Industry" was presented by Mr. Stephen G. Thompson, of the Public Service Electric Company, Newark, N. J. The author reviewed briefly the increase in popularity of the electric vehicle within the last two years in the territory covered by the company and illustrated his point by means of curves showing the increase in both industrial and pleasure vehicles. An analysis of the figures presented shows that 50 per cent of the high-grade trucks now in operation within the territory of the Public Service Electric Company are electrically driven. The second set of curves, showing the increase in kilowatt-hour consumption and the increased income in dollars, together with the curve showing the decrease in the average income rate per kilowatt-hour, were of special interest to the central-station men present. Among those who took part in the discussion were Messrs. J. Becker, W. P. Kennedy, E. W. Curtis, H. W. Hillman, T. F. Bludworth, J. Harris and P. D. Wagoner.

TESTS OF HIGH-TENSION INSULATORS.

"High-Tension Insulator Tests and Specifications" was the topic of a meeting of the American Institute of Electrical Engineers held in New York on Dec. 13. Following the technical session, a smoker was held in the Institute rooms, where refreshments were served.

Messrs. L. E. Imlay and Percy H. Thomas presented a report on "High-Frequency Tests of Line Insulators," a work which was undertaken to find an explanation for certain phenomena arising from lightning and affecting insulators. A paper entitled "Comparative Tests on High-Tension Suspension Insulators" by Mr. P. W. Sothman was read in the absence of the author by Mr. John A. Brundage. This paper dealt with the methods and results of some interesting tests made on 110,000-volt insulators several years ago when 80,000 volts represented the highest existing operating pressure.

The papers were discussed by Messrs. Ralph D. Mershon, Paul M. Lincoln, F. W. Peek, Jr., J. A. Sanford, A. O. Austin, F. M. Farmer and R. W. Pope. The discussion closed with a demonstration by Prof. E. E. F. Creighton of actual breakdowns of pin and suspension-type insulators under high-tension, high-frequency tests.

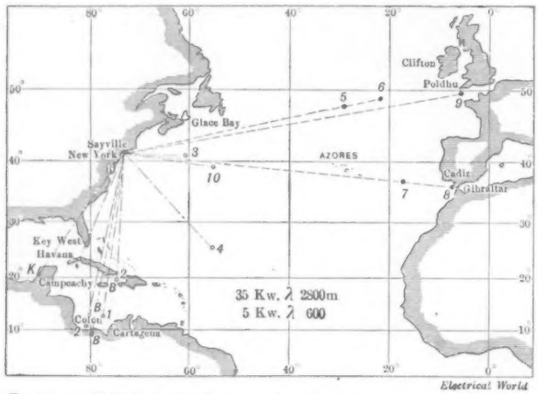
Abstracts of the papers and discussions will be printed in a subsequent issue.

RANGE OF WIRELESS COMMUNICATION FROM SAYVILLE, N. Y.

The wireless station established at Sayville, on the southern shore of Long Island, N. Y., by the Telefunken Wireless Telegraph Company of the United States is in daily communication with vessels passing between America and Europe and also to South American ports. The limit of communication shown by the accompanying map is 5800 km, or to the Straits of Gibraltar. The daily ranges of communication with several of the ships of the Hamburg-American line are shown on the map. The longest distances are worked with a 35-kw plant and a wave-length of 2800 m. The lesser distances are operated with a 5-kw

plant and a wave-length of 600 m. Among the distances shown on the map are the following, all measured from Sayville:

To the steamship *Metapan*, 3515 km; to the *Prinz Eitel Friedrich*, 3500 km; to the *Neckar*, 920 km; to the *San Juan*, 2405 km; to the *George Washington*, 4250 km; to



Ranges of Wireless Communication from Sayville, N. Y.

the *Moltke*, 4600 km; to the *Berlin*, 5800 km; to the *Kaiser Wilhelm der Grosse*, 5250 km; to the *Franz Josef I*, 1480 km.

ELECTRIC-VEHICLE GARAGE SERVICE.

At a meeting of the Chicago Section of the Electric Vehicle Association on Dec. 10, Chairman George Harvey Jones invited a general discussion on the garage situation as affecting electric-vehicle operation. He compared this situation with the central-station lighting methods of twenty years ago, when flat rates prevailed, as they do now in charging for garage service. Mr. Jones pointed out that the measured-service plan is the logical one for garages as well as for central stations.

Mr. H. Bachner, of the Royal Electric Garage, said that there are good facilities for electric pleasure vehicles in Chicago, but that not much has been done in providing garages for trucks. The garage men have no very exact information on the amount of electrical energy used for commercial-vehicle operation. The only method to adopt is to measure the electrical energy used to charge the batteries on customers' commercial wagons. The present flat rate for electric pleasure vehicles is $35 a month. This includes cleaning, oiling, polishing and slight repairs as well as electrical energy. But in the case of both pleasure and commercial vehicles Mr. Bachner believes that the electricity used for charging batteries should be paid for by the customer in accordance with the actual amount used.

Mr. Edwin E. Witherbee, of the General Vehicle Company, spoke of one city where the garage owner makes a flat storage rate of $10 a month for each commercial electric vehicle. In addition, $10 more is charged monthly as a flat rate for washing, oiling, polishing and day-to-day repairs. For pleasure vehicles there is an added charge of $5 per month for delivery to customers as required. Added to these flat charges a rate is made for electricity of 6 cents per kw-hr. for the first 300 kw-hr. and 4 cents per kw-hr. for all energy consumed above that amount. In the case of one 3½-ton truck making from 28 miles to 46 miles a day, these rates worked out from $38 to $41.60 a month for total charges of all kinds.

In the discussion Messrs. George H. Kelly, of the Baker Motor Vehicle Company, L. E. Wagner, of the same company, S. H. Peterson, of the Anderson Electric Car Company, and others took part. The need of a large downtown garage for electric vehicles was conceded by all. Mr. Ernest Lunn, of the Walker Vehicle Company, remarked that there are often 900 standing electric vehicles on the downtown streets of Chicago at one time. One large garage could be used for the storage of pleasure vehicles during the daytime and for the charging of commercial vehicles at night. A committee was appointed to arrange for a joint meeting with the Garage Owners' Association, at which this subject will be discussed further.

Mr. Lunn presented a report from the committee appointed on behalf of the organization to confer with the city authorities in relation to the movement to secure a better regulation of traffic in the congested downtown streets. He indicated the necessity of co-operating with other organizations, and after an informal discussion the committee was instructed to continue its work. It was pointed out that all manufacturers, dealers and owners of electric pleasure automobiles are much interested in the outcome of these traffic regulations.

LIFE INSURANCE FOR EMPLOYEES' CHRISTMAS GIFTS.

Departing from its customary plan of giving its employees turkeys as Christmas presents, the New York & Queens Electric Light & Power Company has this year completed arrangements by which each employee will receive the gift of a life-insurance policy for the amount of his yearly wage or income, good for twelve months. These policies, issued by the Equitable Life Assurance Company, will be paid to the family or nearest relative should the employee die from accident or otherwise during the year. Three hundred and fifty employees will benefit from this arrangement of a blanket policy, which aggregates $300,000 in amount, the premium to be paid by the company. Employees receiving up to $3,000 a year will benefit to the full amount of their incomes, although no employee will be insured for more than $3,000. Mr. C. G. M. Thomas, vice-president and general manager of the New York & Queens Company, also announces the installation of a safety bureau, which will inspect plants and employees' working conditions and suggest precautions and plans for improvement.

THIRD KENNELLY LECTURE ON HYPERBOLIC FUNCTIONS IN ELECTRICAL ENGINEERING.

On Dec. 12 Dr. A. E. Kennelly, of Harvard University, gave the third of his series of five lectures on the application of hyperbolic functions to electrical engineering, at the Polytechnic Institute, Brooklyn, under the auspices of the Brooklyn Institute of Arts and Sciences. The topic for this lecture, previously announced, was "The Behavior of Alternating-Current Lines of Uniform Linear Conductor Impedance." The lecturer first discoursed upon the fundamental differences between simple numeric or scalar quantities and directed or vector quantities, pointing out that the characteristic formulas for direct-current lines of uniform linear resistance and leakance are immediately applicable to the alternating-current case if interpreted vectorially. Dr. Kennelly spoke almost entirely, as before, from lantern slides, many of which illustrated graphically the properties of different hyperbolic functions and the results obtained by applying these functions to transmission-circuit problems.

Any vector quantity in two-dimensional space such as $A \angle\beta$, where A is the so-called modulus or numerical magnitude and β is the *argument* or angle of direction with respect to an axis of reference, can be resolved into two rectangular components,

$$A \angle\beta = A \cos\beta + j \sin\beta \qquad (1)$$

where j is the imaginary operator $\sqrt{-1}$ which implies

that the component $\sin\beta$ is perpendicular to the component $\cos\beta$. The X axis in rectangular or Cartesian co-ordinates is the axis of reals and the Y axis is the axis of imaginaries.

The simple attenuation constant $\alpha = \sqrt{rg}$ in the direct-current case, where r is resistance and g is leakance per mile of line, now becomes

$$\alpha\angle\beta = \sqrt{(r+jx)(g+jb)} \qquad (2)$$

where x is the linear inductive reactance and b the shunt capacity susceptance. Thus α is now a vector or complex imaginary quantity and

$$\alpha\angle\beta = \alpha_1 + j\alpha_2 \qquad (3)$$

The total hyperbolic angle of the line is

$$\theta\angle\beta = l\alpha\angle\beta = \theta_1 + j\theta_2 \qquad (4)$$

The significance of α_1 is that in each mile of the line the potential or the current diminishes or attenuates in value by the factor $\varepsilon^{-\alpha}$, and in the entire line the shrinkage is $\varepsilon^{-l\alpha_1}$ or ε^{θ_1}. The imaginary portion α_2, when employed in the expression $\varepsilon^{-j\alpha_2}$, represents the change of angle or phase in one mile.

Dr. Kennelly then took up the effect of terminal reflection and the process of building up the potential and current distribution in a uniform linear circuit. The formulas for potential and current at the receiving end, in terms of the same quantities at the transmitting end, involve hyperbolic functions of θ, such as $\tanh\theta$, $\sinh\theta$, etc. Lantern slides were presented showing the loci of such functions, in order to familiarize those in the audience with their general character. Tables of hyperbolic functions of complex angles, Dr. Kennelly said, will soon be published.

Then the speaker passed on to the consideration of non-uniform or artificial equivalents of real lines, for laboratory investigations. The nominal and equivalent Π lines for different impressed frequencies were discussed, and specific illustrations were shown by means of lantern slides. Views of the artificial line employed by the speaker were also presented, including the special form of Drysdale potentiometer used in taking measurements of current and potential. He stated that the hyperbolic formulas derived for calculating transmission-line characteristics had all been carefully verified by laboratory tests on this artificial line.

The next lecture on Jan. 9 will be devoted to the calculation of long alternating-current power transmission lines by the hyperbolic method.

OREGON WORKMEN'S COMPENSATION ACT.

Fifty members of the Portland Section of the National Electric Light Association met on the evening of Dec. 10 to discuss the proposed workmen's compensation act, which will be submitted to the Oregon Legislature early in January. The proposed act, which was prepared by a committee appointed by Governor West consisting of representatives from labor organizations, employers and the state grange, provides for an industrial insurance commission and a state industrial insurance fund. The State of Washington already provides industrial insurance by means of a law some of the more important features of which are that every company which has employees engaged in hazardous occupations is compelled to act under its provisions and that the payments made by the companies vary in percentage according to the risks incurred by the employees.

The proposed Oregon law differs very materially from the Washington statute, and from present indications it seems highly probably that it will pass the Legislature in substantially its present form. Unlike the Washington law, it will not be compulsory, and companies and their employees may elect to take advantage of its provisions if they so desire, but if the employer does not elect to take advantage of the provisions of the law he loses the common-law defenses he may have previously enjoyed, such as contributory negligence, fellow-servant rule, etc., and hence it is believed that practically all employers and employees will come under the provision of the proposed statute. The Oregon law calls for the flat payment of an amount equal to 3 per cent of the company's payroll. In addition to this the workman is required to pay an amount equal to one-half of 1 per cent of his wages and the State of Oregon is required to make a contribution equal to that made by the workmen, so that the net result is that the payments will amount to 4 per cent of the payroll. The fund will be handled by a commission of three, appointed by the Governor. It has been the experience in Washington that the payments made by the commission in that State have been rather small, and the Oregon committee has arbitrarily increased the size of the payments to be made under the Oregon law. The average amount of the increase over the Washington payments is 28 per cent, and in addition first-aid services to the injured are also provided, which is not done under the Washington law.

SUIT TO ENJOIN COMPETITOR FROM INDEMNIFYING CUSTOMERS.

"We will indemnify and hold you harmless against any damages you may sustain by reason of discontinuing such electric service as you now have." That the Louisville Lighting Company be enjoined by the court from employing this clause in its contracts with consumers has been asked in a suit filed against that corporation by the Kentucky Electric Company, also of Louisville. The plaintiff, in filing the petition asking for the injunction, has declared that the Louisville Lighting Company employs unfair and unlawful means of visiting the plaintiff's customers systematically and inducing them to break their contracts upon the promise of immunity from trouble or loss. This suit is the third to be filed against the Louisville Lighting Company within two weeks. In two actions the Kentucky Electric Company is the plaintiff, asking $250,000 damages from the defendant because of alleged unfair means of infringing the plaintiff's business and asking that the clause referred to be enjoined. In the other Leo Klarer, a butcher, asks reparation on behalf of several hundred customers of the Louisville Lighting Company in the aggregate sum of $1,000,000, alleging exorbitant and discriminatory rates on the part of the defendant and asking that a special master be appointed by the court to investigate the matter with the view of reparation.

PATENT LITIGATION OVER ENAMEL INSULATION.

For the past twenty-one years there has been litigation involving the use of enamel insulation in electric-heating devices and resistors, illustrated by flatiron rheostats and devices in which a heating conductor is both insulated from and attached to its support by means of enamel. This litigation has been carried on between the Simplex Electric Heating Company and its predecessor on the one side and the Ward Leonard Electric Company and allied interests on the other.

A final decision has been recently handed down by the Circuit Court of Appeals of the Southern District of New York, written by Judge Lacombe, deciding that the enamel devices of the Ward Leonard Electric Company, which employ glass-enamel coatings, do not infringe the Morford patent, No. 490,034, granted Jan. 17, 1893, to Mr. Thomas E. Morford, for an electric heater. The contention of the Simplex Company has been that the "enamel" of this Morford patent included an enamel coating made of glass or in which glass was an essential ingredient. The contention of the Ward Leonard Electric Company has been that the

patent of the Simplex Company issued to Morford was, by a disclaimer in the patent, limited to a non-glass enamel and that patents to Mr. H. Ward Leonard covering glass-enamel coatings were outside of the scope of the patent owned by the Simplex Company.

Many years ago Mr. Leonard sued the Simplex Company, alleging infringement of his glass-enamel patents, and the Simplex Company sued the Ward Leonard Company, al leging that the Ward Leonard glass-enamel coatings were infringements of the Morford patent. The decision of Judge Lacombe upholds the contention of the Ward Leonard Company that its enamel apparatus does not infringe, but the question of whether the Simplex devices are glass-enamel devices within the scope of the Ward Leonard patents is still unsettled.

These litigations forcibly illustrate the bad practice under the present system of patent litigation. The controversy started with an interference in 1891. The first litigation was commenced in 1893, and the final decision as to the Morford patent has just been reached in 1912, two years after the patent had expired and twenty-one years from the beginning of the controversy. Each side has employed successively three different sets of lawyers and the end is not yet. Had the new rules of equity practice in the federal courts, which go into force on Feb. 1, 1913, governed the procedure in this action from the first, it is probable that there would have been a very great saving of time and money on both sides.

VALUATION OF PUBLIC-UTILITY PROPERTIES.

In the course of an address delivered before the Associated Engineering Societies of St. Louis, Dec. 11, on the subject of "Central-Station Statistics and Accounting," Mr. Hermann Spoehrer, secretary and treasurer of the Union Electric Light & Power Company, made some interesting observations on the broader aspects of his subject. He pointed out that in the valuation of public-utility properties allowance must be made for intangible property as well as for tangible property. These intangible values may vary according to local conditions. In some places an allowance is made for franchise value, and in addition the going value is to be taken into account. The relation of the going value to the value of the physical property varies. Cases were mentioned where the value of the intangible property has been fixed at from 6.5 to 20 per cent of the value of the physical property. Under the heading of "intangible property" may be mentioned the item of "superseded property." Investment in "superseded property," where the expenditure was prudently made at the time but has been wiped out by some sudden change in the art, should not be charged against current earnings.

Mr. Spoehrer also described the various methods employed in determining "value" and discussed in an illuminating manner the cost-of-reproduction theory and other considerations to be taken into account in the study of this complicated subject. The matter of allowing interest during construction was also treated.

"Accrued depreciation," so called, said the speaker, is based upon the expiration of a portion of the life of property which is not yet ready for replacement but which must be replaced when withdrawn from service in future. The presence of such "accrued depreciation" does not mean that the property is not maintained at 100 per cent service value.

The fallacy of deducting "accrued depreciation" from the replacement cost to arrive at the value of the property for rate-making purposes was explained at some length. This theory is fully set forth in the case of the Westchester Lighting Company before the Public Service Commission of the Second District of New York.

PATENT DECISION IN SUSPENSION INSULATOR CASE.

An important decision has been handed down by the Commissioner of Patents in the interference case known as Steinberger versus Hewlett. This case arose through an appeal taken by Mr. Louis Steinberger, president and general manager of the Electrose Manufacturing Company, Brooklyn, N. Y., from a decision of the examiner-in-chief confirming the decision of the examiner of interferences awarding priority of invention to Mr. E. M. Hewlett, of the General Electric Company, Schenectady, N. Y., for a disk strain insulator comprising suspension members partially enveloped by a mass of insulating material and having a disk portion provided with annular collars or flanges extending in opposite directions therefrom and generally parallel with the suspension members. The merit of this particular construction was the diminished surface leakage brought about by draining and disposing of the water which would collect upon the insulator in rainy weather. The record shows that Steinberger filed his application for a patent on this device on Jan. 20, 1908, and that the patent was issued on Nov. 17, 1908, No. 904,370. The application by Hewlett was filed April 20, 1907, this being prior to the application filed by Steinberger. Thus the two applications were pending contemporaneously, and Steinberger's application went to issue while Hewlett's application was still in the office. Notwithstanding the fact that Steinberger's patent had actually been issued, his application was afterward declared to be in interference with Hewlett's claims for a similar device.

This, incidentally, discloses one of the serious defects of the present methods in the Patent Office, exhibiting the fact that in the case of two independent applications pending for the same invention it is possible for one of these to be allowed and a patent issued—even in the case of the junior or last application—without first declaring an interference. An excellent illustration is thus afforded of the inherent weakness of a patent as granted under the present system. An inventor cannot be positive that his title to his patent is valid and secure until considerable time has elapsed and it has been completely adjudicated by the courts.

One of the unusual circumstances in this instance is the fact that the senior party, Hewlett, took no testimony at the interference hearings, electing to rest his case upon his filing date. Steinberger, however, raised the issue of originality and contended that he had disclosed the invention to Mr. H. W. Buck, a consulting engineer of New York City, by means of a letter and a sketch, forwarded to the latter on or about Oct. 7, 1905. This disclosure was said to be the result of an invitation from Buck to Steinberger to manufacture some disk or suspension insulators of electrose in accordance with a certain proposed design. A number of designs, according to the testimony, were submitted, one of which made use of a corrugated disk. The records also show that a joint application claiming the invention was filed by Buck and Hewlett on Feb. 15, 1906, and assigned to the General Electric Company, but finally abandoned Nov. 17, 1909. However, on April 20, 1907, Hewlett filed a separate and individual application for the same invention, also assigned to the General Electric Company, which his counsel contends justifies no further presumption than that Hewlett and Buck had come to the conclusion that they were not the joint inventors but that Hewlett was the sole inventor.

The opinion handed down in this case then takes up the question whether the disclosure made to Buck by Steinberger in October, 1905, was a disclosure of the invention at issue, and reaches an affirmative conclusion on the ground that there was no substantial difference between Steinberger's corrugated design and Hewlett's annular collars or flanges attached to the disk. There was also in evidence an earlier patent issued to Steinberger, No. 913,439, filed

Nov. 27, 1905, and issued Feb. 23, 1909. This filing date, the decision notes, is one month and twenty days after the date of Steinberger's letter of disclosure to Buck and much earlier than any date which could be awarded to Hewlett. The opinion holds that this earlier patent clearly discloses the idea and means of providing dry spaces so that the insulation would not be impaired or totally destroyed by falling rain or moisture. The opinion sums up the case as follows:

"In view of the disclosure and of the record presented—viz., the filing of a joint application by Buck and Hewlett, followed by a sole application of Hewlett, both disclosing the invention of the issue—there is no other conclusion possible than that Hewlett derived this invention from Steinberger through Buck, and this conclusion is all the more justified by reason of the fact that Hewlett did not testify or present any record in his own behalf to establish that he was, in fact, the inventor of the issue."

An important and interesting statement of broad principle is also disclosed in the commissioner's opinion, as follows:

"Where in a case involving the question of originality an inventor who is available as a witness fails to take the stand when the facts in his favor, if any there be, are peculiarly within his knowledge, the legal presumption follows that his testimony would be unfavorable to his case."

In substance, the opinion holds that in the light of the record the refinements of language in the claims should not be controlling, and the words "corrugations," "flanges," and "collars" as employed in this particular case are synonymous. It was held that Steinberger is the original inventor, and the decision of the examiner-in-chief was reversed. An appeal has been taken by Hewlett to the Court of Appeals of the District of Columbia. The case is obviously an important one because of the present state of the insulator art and the extended use of suspension insulators in high-tension transmission.

LOUISVILLE INJUNCTION HEARING JAN. 6.

By agreement of the attorneys for both sides, the argument on the motion of the Kentucky Electric Company, of Louisville, Ky., for an injunction to restrain the Louisville Lighting Company from indemnifying or agreeing to indemnify customers which it may secure by inducing them to break contracts already established will be heard in Judge Quarles' court Jan. 6. Mr. Anthony J. Carroll represents the plaintiff in this suit, and Judge Alex. P. Humphrey is counsel for the defendant.

RIGHTS OF A FOREIGN CORPORATION IN KENTUCKY.

Whether or not the Western Union Telegraph Company, as a New York corporation possessing no charter in Kentucky, has a right to possess property and enjoy the privileges of a corporation of Kentucky was argued recently before Judge Walter Evans, of the United States Court, Western District, at Louisville, Ky. The Louisville & Nashville Railroad Company is the plaintiff in the suit against the Western Union, seeking to remove the poles and wires of the defendant company from its rights-of-way in the South, on the ground that its contract with the defendant for telegraph service has terminated and that it desires to establish its own lines and conduct its own telegraph business. Arguments by Col. Henry L. Stone and other attorneys representing the railroad, and by Judges A. E. Richards and Alex. P. Humphrey were heard by the court, and a week's time was allotted both sides in which to file their briefs.

RIGHT OF EMINENT DOMAIN OVER PATENTS.

According to the annual report of Solicitor Henry W. Miller to the Secretary of the Navy, the act of June 25, 1910, authorizing the owners of patents used by the government to bring suit in the Court of Claims for compensation, may prove to have a greater effect than was at first supposed, in simplifying the whole matter of compensating patentees for the use of their inventions by the government. The Supreme Court recently held in the case of Crozier versus Krupp (224 U. S., 290) that inasmuch as the owner of a patent has, under the statute, a remedy for any wrong done to him by the government, such owner could not obtain an injunction against the manufacture by a contractor of the patented article if intended for the government's use. This decision, according to Mr. Miller, places the act mentioned in the category of legislation exercising the right of eminent domain and frees the hand of the Navy Department to appropriate and use without delay the property rights of a citizen without depriving him of just compensation. This privilege, he said, is of great value to the department at all times and will save it, in the event of war, from annoyances of a kind that have reflected discredit on the patriotism of some citizens in the past.

TELEPHONE MERGER AT LIMA, OHIO.

Mr. C. J. Cable, president of the Lima Telephone & Telegraph Company, has announced the purchase of the plant of the Central Union Telephone Company at Lima. The two systems will be merged and the local company will occupy the Central Union exchange. It is said that no material change in the rates will be made, although the Central Union has about 7000 subscribers. New stock will be sold to secure funds to pay for the property.

This merger is representative of the widespread movement which is well under way in the telephone industry. Competition is disappearing and the Bell subsidiary companies are taking over many small independent properties, while in other cases the Bell companies have sold their local plants to independent interests. Lima is a prosperous Ohio city of about 31,000 population.

PROPOSED INVESTIGATION OF HIGH-TENSION TRANSMISSION HAZARDS BY BUREAU OF STANDARDS.

On Dec. 9 Representative Cox, of Ohio, secured the consent of the House of Representatives to an amendment to the legislative bill, accepted by a vote of 63 to 19, providing for an appropriation of $15,000 for an investigation by the Bureau of Standards of the hazards attending the high-tension transmission of electric energy. The amendment was as follows:

"To investigate the dangers to life and property due to the transmission of the electric current at high potentials and the precautions to be taken and the best method of construction, installation and operation to be followed in the distribution and return of such current in order to reduce to a minimum such dangers; also to investigate the best means of protecting life and property from lightning, including personal services, in the District of Columbia and in the field, $15,000."

In introducing the resolution Mr. Cox said in explanation of it:

"The provision here is that the Bureau of Standards shall now make practical use of certain laboratory apparatus which was purchased under an authority granted during the

session of the last Congress. Let me remind members of this House that every state in the Union which is keeping step with the progress of the age has created a so-called public-utilities commission, and it is the purpose of this subdivision of state governments not only to regulate the rates which are assessed against individuals but to protect in the largest measure possible human life. Living in the North, as many of us do, I think we have a measurably full appreciation of the tremendous dangers which now are part of the great industrial activities of this age. In our neighboring State of Indiana the most important question now is the passage of a workman's compensation act, in order that there may be taken from the courts every piece of litigation which joins to personal-injury cases. The President of the United States, in submitting his message here the other day, dilated upon the importance, the propriety and the justice of this legislation. We want to go deeper. We want to touch a more important fundamental of this subject by preventing this harvest of deaths. The public-utilities commissions in the States desire to install certain safety devices which will be fair to corporations and which will be fair also to the people. They want to know what the best safety devices are, and then they can standardize them.

"Civilization now calls upon this Republic, through Representatives here assembled, to give to the highest authority in this land, the Bureau of Standards, the task of determining the safety devices which ought to be installed in order that public-utilities commissions in the States can then have them standardized and applied. The cost is only $15,000 per year. The apparatus for experimentation has been purchased. I want to remind gentlemen that I have in my hand now press clippings from the newspapers of the day covering but a short time, and yet they tell the story of countless human tragedies. I do not want to appeal in any improper way to the sentiment or the impulse of this House, but there is not a provision in this bill which is half so important to the country as the amendment which has just been introduced."

As the result of objections to the amendment by Representative Johnson, of South Carolina, there was an extended debate and the proposed investigation was indorsed by Messrs Cannon and Buchanan, of Illinois; Hobson, of Alabama, and others. Much of the discussion centered around the relative importance of this and other investigations by the Bureau of Standards and whether the protection of property should be superior to the protection of human life. There is said to be little doubt that the Senate will concur in the amendment.

NOMINATIONS FOR THE UNITED STATES COMMISSION ON INDUSTRIAL RELATIONS.

Nominations of nine individuals to compose the United States Commission on Industrial Relations were sent to the Senate by President Taft on Dec. 17. These nominations were as follows: Representing the general public, Senator George Sutherland, of Utah; Mr. George B. Chandler, a member of the Connecticut Legislature, and Mr. Charles S. Barrett, of Union City, Ga., president of the Farmers' Union. Representing capital, Mr. Frederic A. Delano, of Chicago, former president and now one of the receivers of the Wabash Railroad; Mr. Adolph Lewisohn, of New York, owner of copper mines and a manufacturer, and Mr. Ferdinand C. Schwedtman, of St. Louis, Mo, an electrical engineer and also vice-president of the National Manufacturers' Association. Representing labor, Mr. Austin B. Garretson of Iowa, president of the Order of Railway Conductors; Mr. John B. Lennon, of Bloomington, Ill., treasurer of the American Federation of Labor, and Mr. James O'Connell, of Washington, D. C., vice-president of the American Federation of Labor.

The commission was authorized by act of Congress approved Aug. 23 and its main purpose will be to discover the underlying causes of dissatisfaction in the industrial situation and report its conclusions thereon. The scope of the investigation will be exceedingly broad, covering all phases of the mutual relationships among employers, wage-earners and the public. The act appropriated $100,000 for the use of the commission for the fiscal year to end on June 30, 1913. The final report, accompanied by testimony taken at the hearings, must be made not later than Aug. 23, 1915.

PROPOSED NEW YORK CITIZENS' COMMITTEE TO SAFEGUARD APPOINTMENTS TO PUBLIC SERVICE COMMISSIONS.

Copies of a letter proposing the formation of a state-wide citizens' committee to secure non-partisan appointments to fill vacancies in the two public service commissions have been sent to well-known men in every county in New York State. These letters were signed by Messrs. William J. Schieffelin, chairman of the Citizens' Union; Seth Low, former Mayor of New York, and J. Hampden Dougherty, Dr. Henry Moscowitz, Eugene A. Philbin and Allan Robinson. The letter calls attention to the vacancies in the two commissions which it will become Governor-elect Sulzer's duty to fill in the near future and points out the great importance of selecting the new incumbents on the principle of fitness for office. If, on the other hand, the appointees are selected on the basis of political party patronage it seems certain that these great commissions will be turned over to the party bosses as spoils.

There are unlet subway contracts in New York City amounting to nearly $300,000,000, and there are, moreover, exempt positions under the commission paying a total of $135,000 annually in salaries. These conditions furnish the strongest temptation to political organizations to secure control of the patronage which would be theirs if only their favorites could be appointed to fill the approaching vacancies in the two commissions. The letter also states that it will be the object of this citizens' committee for non-partisan public service regulation to inform the people of the State of the critical situation and to urge upon the Governor and the Legislature the great importance of upholding the principle of appointment to the public service commissions on the sole basis of individual fitness, as inaugurated by Governor Hughes, and not of political party.

SULZER BILL FOR A SINGLE COURT OF PATENT APPEALS.

It is expected that the bill introduced in the House of Representatives shortly before the close of the last session by Representative Sulzer, Governor-elect of New York, providing for a United States Court of Patent Appeals, will take an important place in any patent legislation which it is attempted to pass at this session of Congress. A hearing was held on the bill on Dec. 6, and others will probably be held during the winter.

The bill provides for five judges, four of whom shall constitute a quorum; for a clerk and marshal who shall perform the same duties as those performed by similar officers of the Supreme Court; for the same costs and fees now exacted in the Supreme Court; that the President shall appoint a chief justice of the proposed court, and acceptance of that office by a judge of the circuit court or district court shall vacate his office as circuit or district judge; that

the chief justice of the Supreme Court shall designate from among the judges of circuit and district courts four judges to sit as associate justices of the proposed court, two for three years and two for six years, all appointments after the first appointments to be for six years; that associate judges so appointed shall not lose their offices as judges of the circuit court or district court as the case may be; that a term of the proposed court shall be held annually at Washington beginning in October, provided there is a quorum of four present; that the senior associate justice shall serve as chief justice in the absence of the chief justice; that the chief justice shall receive a salary of $10,000 a year; that the circuit judges sitting as associate judges shall receive not more than $9,500 per annum for holding both judgeships; that district judges shall receive while sitting as associate judges not more than $11,000 per annum for holding both judgeships.

The bill provides furthermore that the proposed court shall have jurisdiction to hear and determine appeals and writs of error from final judgments and decrees in the circuit courts of the United States in cases relating to patents for inventions and from final judgments and decrees in cases relating to patents for inventions rendered by any other court having jurisdiction to hear and decide such cases in the first instance, provided that it shall have no jurisdiction in cases originating in the Court of Claims, all such appeals to be taken within six months after the entry of the order, judgment or decree sought to be reviewed; that the practice, procedure and forms of the Supreme Court shall be used; that whenever, by an interlocutory order or decree in a circuit court of the United States or other court having jurisdiction under the laws of the United States to hear and decide in the first instance cases arising under the patent laws, in a case in which an appeal may be taken from the final decree of such court to the proposed court, an injunction or restraining order shall be granted, or refused, or modified, an appeal may be taken from such order or decree by the party aggrieved to the proposed court, provided that the appeal must be taken within thirty days from the service of the notice of entry of such order or decree; and it shall take precedence in the appellate court, and the proceedings in other respects in the court below shall not be stayed unless otherwise ordered by that court, or the proposed court, during the pendency of such appeal.

Further clauses stipulate that in every case determined by the proposed court upon appeal or writ of error the case shall be remanded to the circuit court of the United States, or other court from which it came, for further proceedings; that all appeals and writs of error in cases in which appellate jurisdiction is by the act conferred upon the proposed court and which shall have been pending without hearing in the United States circuit courts of appeals or other courts of appellate jurisdiction for less than three calendar months prior to the taking effect of the act shall be transferred to the proposed court and be heard and determined as though they had been taken there from the trial courts by appeal or writ of error, without further payment for certifying the record or any new or additional docket or calendar fees; all other appeals and writs of error in cases in which appellate jurisdiction is by the act conferred upon the proposed court and which shall be pending in the United States circuit courts of appeals or other courts of appellate jurisdiction at the time of the taking effect of the act shall remain and be heard and determined by the courts in which they may be pending respectively as though the act had not been passed; that after the taking effect of the act no appeal or writ of error shall be taken from any circuit court or other court of the United States to any circuit court of appeals or other appellate court in any case in which an appeal or writ of error may be taken to the proposed court under the provisions of the act, and that the act shall take effect six months from its passage.

The first hearing on the bill was held before the House sub-committee on the judiciary, Representative H. Garland Dupree, of Louisiana, presiding as acting chairman. He was assisted by Representative J. Beall, of Texas. Statements were made by Messrs. Charles F. MacLean and Charles C. Copeland, of New York City; Mr. James T. Hoile, secretary of the Merchants and Manufacturers' Association, of New York, and Mr. Frank S. Gardner, secretary of the New York Board of Trade and Transportation.

Mr. MacLean pointed out that the bill was drawn before the law doing away with the Circuit Court as it formerly existed went into effect at the beginning of the year, although it was introduced Aug. 14, 1912. He said there had been criticism because of the high salary of the judges. He declared the bill was drawn in accordance with the modern trend to create a court which would occupy itself entirely with one matter—patent cases—to the end that there should be a continuity of decisions, to the end further that persons serving as judges in the proposed court should not only be peculiarly qualified for the consideration and decision of cases involving technical matters in patent cases but also should have special knowledge of mechanics, kinetics and dynamics.

"The persons who have interested themselves in the progress of this bill," Mr. MacLean said, "especially members of the Board of Trade and Transportation of New York, are of opinion that the persons appointed as judges of this court should have special qualifications for such judiciary. Many years ago, for example, in what are called the 'driven-well' cases, there were decisions in different parts of the country sustaining the driven-well patents until at last it was the opinion that those patents would stand in any jurisdiction. The case came up before a court in which Justice Blanchard presided and the driven-well patents were all set aside. The so-called Mergenthaler patents came up in New York before a justice, an accomplished man whose experience had been originally in a rural district and who did not profess to have any special acquaintance with mechanics, and the case resulted in a decision that made the Mergenthaler patent practically invulnerable."

Mr. MacLean said that one objection others have offered to the bill is that the court is, under the act, to sit in the capital. He did not think that was important, because only counsel as a rule are required to make journeys for appearance at such courts, evidence being taken by deposition. He thought it was useless to wait for forming a Court of Patent Appeals until the entire procedure of the courts had been revised. All reforms, he said, were brought about by discontent and each of them had been largely a special reform, such as this proposed new court.

Permission was extended to Mr. MacLean to add to his remarks, when revising the record of his hearing, and he was asked to furnish the committee with a statement showing the volume of patent litigation in this country and the necessity for the creation of the proposed special court.

Mr. Copeland spoke in regard to the indorsements of the bill by various organizations. He promised to furnish the committee with written duplicates of these. Speaking as to the necessity for the act, he said:

"It was my privilege to interview many of the leading patent lawyers of New York State with regard to this bill. Judge Dwyer, of Dwyer & Taylor, who is Mr. Edison's lawyer and who represents a number of large corporations, said to me that there would be more than ample work for a specialized court to do, and further that it would be a great relief to the other federal courts to take up the cases which they had, many of which were outside of their regular cases. I might say that nearly all the leading patent attorneys have indorsed this measure, and that the American Bar Association has indorsed it. Judge Robert S. Hulse, of Taylor & Hulse, Fort Wayne, Ind., writes me: 'I have given much time and labor to the advocacy of this bill. I wrote the original bill some ten or twelve years ago and have followed its course from one Congress to another

ever since. Its fundamental provisions remain unchanged. The need for the court is as great to-day as it ever was.'"

Mr. Copeland then read from a letter from Mr. S. O. Edmonds, of Edmonds & Edmonds, New York City, in which the latter said: "I offered a resolution yesterday at a special meeting of the committee on patents and trademarks of the New York County Lawyers' Association approving the Sulzer bill and urging its early passage. In addition, I have prepared and am now circulating a petition which I expect to have signed by the leading members of the patent bar here in New York." Mr. Copeland further produced indorsements from Mr. Henry Houston Kenyon, of New York; Mr. Charles C. Bulkley, of Bulkley & Durand, Chicago, and Mr. Arthur L. Morsell, of Morsell & Caldwell, Milwaukee. He also said that every patent bar association in this country and almost without exception every leading commercial organization has indorsed the bill.

Mr. Frank S. Gardner, secretary of the New York Board of Trade and Transportation, submited a copy of a report from a committee appointed in the interests of the bill.

Mr. James T. Hoile, secretary of the Merchants and Manufacturers' Association, of New York, submitted a statement in which he said that the layman has become wedded to the idea that to be interested in a patent is to be interested in a lawsuit. "The government," he said, "gives us a piece of paper which is practically an order to go to court." He explained the necessity for the court from a business and commercial point of view.

FEDERAL WATER-POWER POLICY.

On Dec. 16 President Taft sent to Congress the annual report of Secretary of the Interior Walter L. Fisher, a considerable portion of which was devoted to the subject of water-power regulation and the proper attitude of the government toward the leasing of federal water-power sites. What follows is taken from Mr. Fisher's report.

"There is no more important subject now pending before Congress and the country than the adoption of a definite and comprehensive water-power policy, both with regard to streams upon the public domain and navigable streams not on the public domain. During the past year the subject has received much attention in Congress and elsewhere. The hearings before the National Waterways Commission were especially important and resulted in a unanimous report * which marks at least a definite step forward toward a constructive water-power policy. Bills have been introduced providing for the definite adoption of such a policy with respect to public lands. The passage of two bills by Congress authorizing dams in certain navigable streams and the discussions over these bills and over the forceful messages in which they were vetoed have clearly pointed out the necessity for amendment of the general dam act and have suggested the amendments which would be appropriate.

"When it became apparent that Congress was not likely to act with respect to water-power sites upon the public domain, a series of conferences was arranged between the representatives of the Department of Agriculture and the Department of the Interior for the purpose of drafting a comprehensive revision of the regulations of these two departments with respect to permits for water-power development in the national forests and on the public domain generally. The revised regulations were put into effect by the Department of the Interior on Aug. 24, 1912, so that their effect might be carefully considered by those who are interested in water-power development, and on Nov. 18, 1912, a largely attended conference with representatives of important water-power interests and of the state conservation, water and railroad commissioners of California was held in the office of the Secretary of the Interior for the purpose of discussing the relations between the state and national governments with respect to water-power, and especially of considering such modifications in the laws and regulations as might be suggested in order to co-ordinate the functions of the nation and the states and make the regulations, whether state or national, sufficiently liberal to encourage vigorous development and at the same time to protect adequately the public interests. The conference demonstrated the feasibility of effective co-operation for the reconciliation or adjustment of the different interests, state and national, public and private. Many helpful suggestions were made, which are now under consideration.

"The fundamental purpose of a rightly considered water-power policy is the encouragement and stimulation of the development and use of this great natural resource for the benefit of the public and along lines which will protect and promote the public interest. Its object is development, but development for the benefit of the public. The first public interest is that the water-power shall be developed and utilized, but some forms of development and utilization are obviously better calculated to promote the public interest than are other forms. It is therefore essential that we should determine what form of development will best promote the public interest.

"So far as government itself does not undertake the development of water-power it is therefore necessary and desirable that we shall offer to those private interests which do undertake its development a sufficient opportunity for profit and a sufficient protection of their investment to secure the largest measure of development for which there is a present market or for which a market can profitably be created. It must be equally apparent, however, that to the extent to which we offer an unnecessary inducement we are depriving the community of the very benefits upon which the present theories of industrial society depend.

"Above all, we must make certain that those who receive special privileges connected with water-power development shall in fact proceed by appropriate degrees and within appropriate times to develop the available water-power to its highest capacity, having due regard to the possibilities of marketing the product. We must make certain that the electric energy thus created shall be made available to the community in appropriate ways at appropriate prices. If it is not to be used for the benefit of the community but is to be devoted directly to the private purposes and personal advantage of the permittee, some method must be found by which the public will receive its share of the profit which the permittee may make over and above that which is a necessary and reasonable inducement for his investment.

"The theory of our present law in these particulars appears to be that the only way in which the public interest can properly be protected is by providing that the permit may be revoked at any time by the official who grants it. To-day, however, the revocable feature of the existing law is a serious and unjustifiable obstacle to the development and utilization of one of the nation's greatest natural resources. It should be stricken out of the law, but it should be striken out only if there are inserted in its place statutory provisions which will define or authorize the appropriate executive agency to define by regulations the conditions and limitations upon which the permit is issued and for a breach of which it shall be canceled.

"It would seem to be axiomatic that where any governmental agency, whether state or federal, owns or controls a natural resource that agency should take such steps and adopt such policies as will insure that this natural resource is being utilized for the benefit of the community. If the particular agency, state or federal, is called upon to expend moneys for the protection or improvement of the resource and the resource itself can, without detriment to the community, be made to produce revenues out of which such expenditures can be paid, this course should be adopted.

*Senate Document No. 469, Sixty-second Congress, second session.

The proposition thus laid down seems to be conceded, reluctantly in some cases but freely in others, by those who are interested in water-power development. As a rule also they concede further that if water-power is being developed and used directly by the permittee for its own financial profit and not as a public utility, the particular governmental agency issuing the permit can and should require the payment of such substantial compensation as the facts in any given case may warrant.

"Upon the other hand, however, they vigorously contend that much, if not most, of the water-power development upon navigable streams and upon the public domain is, in fact, in the nature of a public utility, in that it is devoted to the generation of electric current which is sold by the permittee for general consumption by the public for light, heat or power. They now state frankly that this development should be treated as a regulated public monopoly. Some of them contend that for this reason no compensation whatever should be exacted by the government which grants the permit, but on the other hand those private interests whose representatives are really candid are preparing to admit that public regulation of these utilities is, generally speaking, not yet efficient, and that to the extent to which it fails to be efficient the government is justified in exacting compensation. They admit further that for the purpose of keeping control of the situation and upon broad general principles of public policy the government is justified in imposing a nominal compensation even in cases where public regulation appears to be reasonably effective, and that provision for periodic readjustment of this compensation will be a useful check in securing such efficient regulation. Indeed, the only controversy of importance appears to be whether the federal government or the states shall control the granting of water-power permits and shall collect the compensation.

"So far as concerns water-power concessions upon streams which are not navigable, the federal government is directly concerned to-day only where the application is for the use of some portion of the federal domain. The important question is whether the federal government should retain its control over such power sites and upon what conditions the concession shall be issued. The suggestion is made frequently by those who are in one way or another representing either present or future investment in water-power development that such power sites and their control should be turned over to the respective states in which they are situated. It is suggested that in some way or other a failure to do this is a usurpation of federal power and an unfair discrimination against the Western States. It is interesting, however, to note that the ordinary citizens of these states are not at all concerned over federal usurpation or unjust treatment. They recognize that the federal government has full legal power to dispose of the public domain as wise policy may direct. They do not fear federal usurpation, but seek federal co-operation in supplementing state and local powers, so that the natural resources shall be utilized for the public benefit primarily of the locality in which these resources are situated, and thus ultimately for the benefit of the nation as a whole. They suspect that the real purpose of those who urge the turning over of the federal domain to the states is that they may escape the longer and the stronger arm of the federal government and may take advantage of the more limited resources and governmental facilities of the individual states.

"There is no real conflict between the nation and the states upon this subject. In fact, there can be no real solution of these aspects of the problem until the interest and the functions of the nation and the states are co-ordinated and they are working together for the same essential ends. In general, all of the streams which are susceptible of water-power development are also of great importance for domestic use, for irrigation or for navigation. All of them depend to some degree upon protection and aid of some kind and from some source for one or more of these uses. Increasingly that source tends to be the nation and not the states.

"Theoretically the states can develop and protect the streams and the watersheds of the streams within their respective borders, and if these streams are interstate in character the states affected can unite in plans and expenditures for their joint protection and development. Practically, however, the tendency is increasingly in the direction of federal action upon such matters. Some of the individual states are developing effective policies of water conservation, but it is the federal government after all which is called upon to make the chief expenditures for the development of navigation and for the protection of the forest cover around the sources and along the watersheds of both navigable and non-navigable streams. It is the federal government which will be asked to build the reservoirs in which to impound the flood waters at their source so that devastation may be prevented and stream flow be made regular and beneficent. It is the federal government which has established and is maintaining the forest reserves by withdrawing appropriate areas on the public domain and purchasing other areas in the Appalachian and other mountains of the Eastern States. The states which are jointly interested in the disposition and development of interstate waters not only do not co-operate with each other but are in fact antagonistic. No better illustration of this can be found than in the present attitude of state officials and some citizens of Colorado toward the utilization of the waters of the Rio Grande for the irrigation project in Texas and New Mexico authorized by Congress partly for the benefit of these states but largely in settlement of an international controversy with Mexico.

"If, then, the nation is to perform these important functions, if it is to make these expenditures, if it is to be the arbiter and harmonizer of conflicting state interests, there would seem to be every reason why the nation should retain the fullest measure of control necessary or appropriate to enable it to perform these functions effectively.

"It is true that much of the hydroelectric energy developed under federal permit will be sold to local communities and their inhabitants for general lighting, heating and power purposes, and that the local communities affected are therefore vitally concerned in the character of the service rendered by the permittee and in the charges for this service. The improvement of long-distance transmission will tend to change this local interest into an interest interstate in character, and this change will lead to the necessary assertion of the federal power over interstate commerce, as has been the case in the field of railroad enterprise, but until that time comes, and except as it does come, it should be a fundamental principle of federal water-power policy to relegate to the states and their delegated agencies, whether such agencies be the local municipalities or the public-utility commissions, the important function of regulating the service and the rates of hydroelectric public utilities. It should equally be a feature of federal policy to utilize the revenues derived from water-power permits solely for the purposes of water development, thus returning to the local communities, not by any nice adjustment of particular expenditures to particular receipts, but as a general policy, the contributions which these communities may directly or indirectly make to the federal treasury. Where the local community is efficiently regulating the rates and services of these permittees, the federal charge should be nominal in amount, but it should be susceptible of periodic readjustment, so that official inquiry may be made into the extent to which local regulation is efficient, and if for any reason such regulation is not effective and the permittee is enjoying an unconscionable profit, this profit may be diminished by appropriate increases of the federal charge. Such a policy can in no way injuriously affect the legitimate interests of the private investor or the local community."

PUBLIC SERVICE COMMISSION NEWS.

NEW JERSEY COMMISSION.

The commission has recently approved uniform systems of accounting for electric light, heat and power companies, gas companies, water companies and street-railway companies. Numerous hearings have been held by members of the board, and there have been many conferences during the past year between the board's accountant and representatives of the utilities affected, and the uniform systems of accounts adopted are the result. A pamphlet containing the uniform system for each utility has been served on each of the companies affected, with an order of the board requiring its adoption, the order becoming effective on Dec. 31 of this year. The system of accounting as adopted by the board is comprehensive, and the board has notified each of the utilities affected that its order does not contemplate that all the accounts are pertinent to the facts and circumstances of every company, without regard to its size and importance, but that in all cases where there is doubt as to the pertinency of any account the utilities should communicate promptly with the board, and that the board will aid them to comply in a reasonable manner with its order.

Notice has been given by the board to every municipality in the State operating any form of public-utility service for which the uniform systems of accounts have been prescribed, notifying such municipalities of the provision of the law which requires that "every municipality operating any form of public-utility service shall keep the accounts thereof in the manner prescribed by the board for the accounting of similar public utilities."

MARYLAND COMMISSION.

The Maryland Public Service Commission has received additional data bearing upon the operating expenses of the Consolidated Gas, Electric Light & Power Company. These data are for the purpose of bringing the commission's information up to date and having the matter of reasonable operating expenses considered in connection with the electric rate question.

To pay for improvements and extensions made to its property between Dec. 1, 1911, and Oct. 31, 1912, the Consolidated Gas, Electric Light & Power Company has filed a petition with the Maryland Commission for authority to issue $747,000 of 4½ per cent bonds. The proposed issue is a part of the improvement bonds now remaining in the treasury of the company. Schedules of the improvements made and planned are filed with the petition and both the gas and electric divisions are included. Mr. Albert C. Ritchie, assistant general counsel to the commission and people's counsel in the rate investigation, has not decided whether to oppose the request.

OHIO COMMISSION.

In its annual report to the Governor, the Public Service Commission severely criticised the railroads and traction companies on many points. It recommends that the laws be amended in such a manner as to make 2 cents a mile the maximum for interurban companies, without the 10-cent minimum charge. It is suggested that the minimum be no more than 5 cents. It was stated that in certain instances where electric roads have no competition from steam lines the rates have been increased to more than 2 cents a mile and the commission has been powerless to interfere. In most cases, however, the traction rates are 2 cents a mile or less.

The commission recommends that the law be changed so as to permit utility corporations to sell more bonds than stock, if this be desirable. It is stated that investors often prefer bonds to stocks and that these corporations have, for this reason, often been compelled to sell their stock at too low a figure. Such a change would remedy the trouble to a certain extent. In order to overcome this situation the commission admits that it has permitted some of the companies to overcapitalize, when assured that the proceeds of the stock issues would be honestly spent in improvements and extension. It was better to take such a step to improve a bad situation than to allow it to go on without hope of improvement, the report stated.

The commission feels that there should be some way to compel witnesses to attend the hearings. Some of the companies refuse to pay their men for the time spent in attending the hearings and it has been difficult at times to have them present. It is suggested that this trouble be remedied by legislation.

INTERSTATE COMMERCE COMMISSION.

The twenty-sixth annual report of the Interstate Commerce Commission, submitted to Congress on Dec. 16, includes a recommendation that the authority of the commission over telegraph and telephone corporations be more explicitly defined.

Current News and Notes

Electric Club of Chicago Investing Its Money.—During its existence of less than five years the Electric Club of Chicago has accumulated a comfortable surplus. At the meeting of Nov. 21 it was voted to invest $3,000 of the funds of the club in the 5 per cent first-mortgage gold bonds of the Commonwealth Edison Company. Mr. John R. Harmon is treasurer of the club, which has a membership of 350.

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"Electroforce."—The students of the School of Engineering of Milwaukee have started a monthly magazine known as *Electroforce*, which is said by the sub-title to be "a technical magazine for everybody." The paper is attractively printed and illustrated, and the youthful editors are evidently enthusiastic and very much in earnest. They say that the paper is not published for financial gain, "but for the uplift of electricity and minds electrical." Readers are assured that "trash will be refused and not published, and subjects of interest and vital importance only will appear." The paper "is not published by a set circle of men and foisted upon the electrical public as are other publications." No, indeed; "*Electroforce* is the official organ of the world electrical, the instrument by which all of us can be heard, and it is the tie that binds all members of the electrical family whatever each one's part in its glorious activity is."

* * *

Memphis Telephone Ordinance Held Invalid.—In the case of the Cumberland Telephone & Telegraph Company against the city of Memphis, the United States Circuit Court of Appeals has handed down a decision to the effect that the city has no authority to regulate the rates charged for service by the company. The case is remanded to the United States District Court at Memphis with directions to grant the injunction desired by the company. In the opinion, which was written by Judge Denison, it is stated that the power to regulate the rates of a public utility is a legislative one held by the State and not by the city and, therefore, the rate ordinance enacted by the City Council of Memphis is invalid. It is held by the court that the Legislature of Tennessee has not granted to municipalities either specifically or indirectly the right to regulate the rates charged by telephone companies, although it has specifically granted them the right to regulate district-telegraph, gas, street-car, belt-line-railroad and switching companies. If the rates charged in Memphis are unreasonably high, the court says that the Legislature will doubtless proceed to regulate them or delegate that authority to municipalities, although it has not yet done so.

OIL-LAND RESERVE SET ASIDE FOR THE UNITED STATES NAVY.—President Taft on Dec. 12 signed an order placing in reserve for the use of the navy several thousand acres of rich oil land in southern California. This will increase the total navy reserve of oil lands to nearly 45,000 acres. According to an estimate made by the Geological Survey, the oil supply in the withdrawn area should last the navy for thirty-five years.

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CENTRAL STATION CONTROVERSY AT KENTON, OHIO.—The controversy between the city of Kenton and the Hardin-Wyandot Lighting Company will probably be amicably settled within a short time, although it has been in the courts for months. As a result the city expects to secure a reduction in the gas rate, elimination of the meter charge and the construction of a new plant in return for allowing the company to furnish electric energy to other towns.

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PATENT COMMISSION RECOMMENDED BY NEW YORK MANUFACTURERS' ASSOCIATION.—At a recent meeteing held in Brooklyn, N. Y., the Manufacturers' Association of New York adopted resolutions urging Congress to provide a non-partisan commission to consider the whole question of the revision of the patent law and practice. It was also voted to request that the commission hold public hearings in New York and in other cities where it may be deemed advisable.

* * *

WORKMEN'S COMPENSATION BILL.—A new workmen's compensation bill has been drafted by the executive board of the New York State Federation of Labor for presentation to the next Legislature. The proposed law would apply to all workshops and would include longshoremen, chauffeurs and drivers of automobile trucks as men engaged in hazardous occupations. The compensation fund would be contributed entirely by the employers. The bill also provides for a state commission to administer the funds.

* * *

SECRETARY OF THE INTERIOR FISHER RECOMMENDS NEW PATENT OFFICE BUILDING.—The annual report of Secretary of the Interior Walter L. Fisher to President Taft for the fiscal year ended June 30 indorses the recommendation of the Commissioner of Patents for a new building for the United States Patent Office. Secretary Fisher emphasized the crowded condition of the present quarters, the serious fire risk which now exists, and the general lack of efficiency under present conditions. The annual report of the Commissioner of Patents was abstracted in our issue of Aug. 3, page 233.

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INVESTIGATION OF PUBLIC UTILITY REGULATION.—The National Civic Federation has recently distributed preliminary page proofs of three portions of its "Compilation and Analysis of Public Utility Regulation Laws of the United States," dealing with inter-corporate utility relations, franchises, and stocks and bonds. Each of these parts is one of sixteen similar portions of the total compilation and analysis, being printed and distributed to interested persons for criticism and suggestion. We have made previous announcements from time to time of the distribution of other portions of this compilation, and elsewhere in this issue there appears a general summary of the whole investigation and its progress up to this time.

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HEARINGS ON TARIFF REVISION.—According to Representative Underwood, the Democratic leader of the House of Representatives, the tariff hearings before the ways and means committee will be finished by the end of January, if possible. This commitee, of which Mr. Underwood is chairman, is already fortified with what it regards as very full information regarding all the tariff schedules. By adopting a schedule of hearings beginning Jan. 6, it is hoped to give everyone interested an opportunity to present opinions on any particular schedule. Schedule C—metals and manufactures—will come up for hearing on Friday, Jan. 10. This program of activity on the part of the committee is in anticipation of an extra session of the new Congress, the call for which it is expected will be issued by President-elect Wilson soon after he takes office on March 4.

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WESTERN UNION TELEGRAPH COMPANY WINS OVER LOUISVILLE & NASHVILLE RAILROAD COMPANY.—During August last the reciprocal contract between the Western Union Telegraph Company and the Louisville & Nashville Railroad Company, under which the telegraph company occupied the railroad right-of-way with its pole lines, expired. The railroad company then ordered the telegraph company to remove its lines and equipment, and the matter was taken into the courts. On Dec. 17 a decision was handed down by Judge Evans in the federal court holding that the railroad company had no right to force the telegraph company to remove immediately its equipment from the railroad system in the State of Kentucky The decision was based on an act of the Kentucky Legislature which gives a telegraph or telephone company the privilege of condemning a right-of-way along the road of a common carrier. Judge Evans also held that the matter of compensation for a right-of-way should be left to a jury.

* * *

RETIREMENT OF INTANGIBLE VALUES.—Testifying before the arbitration board which has been reviewing the wages and working conditions of the Chicago City Railway Company, Mr. Bion J. Arnold, chairman of the Board of Supervising Engineers, Chicago Traction, discussed tangible and intangible values. He said that he had been thinking of some method of improving the Chicago traction settlement ordinance ever since its passage five years ago and had concluded that some provision should have been made for retiring the intangible value placed on the property. This intangible value might have been retired by dividing the net profit into three parts instead of two, as required now, one part to be set aside to retire intangible value and the other two to go to the city and company. This method has been recommended for the proposed charter at San Francisco. Mr. Arnold went on to say that he believed that the fund set aside to retire intangible value, with interest, would more than pay the amount required in twenty years.

* * *

SANITARY DISTRICT DECLARES AGAINST COMMERCIAL SALE OF ENERGY.—One of the first acts of the Board of Trustees of the Sanitary District of Chicago, after reorganization as the result of the recent election, was to adopt a resolution making an important declaration of policy. The trustees control the hydroelectric development of the Chicago Drainage Canal, and the resolution sets forth the new board's attitude toward the sale of electrical energy. By its terms it is declared to be the future policy of the trustees to supply, as far as practicable, its entire output of electrical energy for the uses of the various municipalities within the limits of the Sanitary District and in particular for the city of Chicago for electric street lighting. A considerable portion of the electrical energy generated by the Sanitary District at the Lockport (Ill.) water-power station is sold to commercial concerns, but it is now declared to be the policy of the board to withdraw from the industrial field as fast as practicable. To some extent the Sanitary District has been in competition with the Commonwealth Edison Company, the Cosmopolitan Electric Company and the Public Service Company of Northern Illinois in the sale of electrical energy to private consumers, mostly owners of industrial plants.

Electrical Construction at Greeley, Col.—Greeley, Col., whose population is 8000, has just enacted a new ordinance making mandatory the grounding of transformer secondaries throughout the city and the use of conduit in all new wiring or rewiring inside the fire limits.

* * *

Proposal to Combine Smoke Inspection and Boiler Inspection in Chicago.—Following accusations of "graft" against one of the deputy smoke inspectors, the Aldermen of Chicago have under consideration a plan of combining the bureau of smoke inspection with that of boiler inspection.

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"Home Rule" Demanded by Aldermen for Chicago Utilities.—As the result of the recent "home-rule" agitation following the visit of the Illinois Legislative Public Utilities Commission, the Chicago City Council has adopted a resolution protesting against commission control over Chicago public utilities.

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Workmen's Compensation.—President E. W. De Leon, of the Casualty Company of America, recently delivered an address before the Insurance Society of New York on "Some Phases of Workmen's Compensation in the United States." One very pronounced phase of the universal movement for workmen's compensation, said the speaker, is the tendency toward monopolistic state insurance schemes, some of which he declared to be radical and socialistic in the extreme. He surveyed the situation in the several states which have adopted workmen's compensation laws and indorsed the broad humanitarian principle of the movement.

* * *

How Hard Is the Way of the Inventor.—In a letter to the editor of the New York *Evening Post,* under date of Dec. 17, Mr. George H. Benjamin, of New York, in referring to the $10,000 offer by a railroad president for a satisfactory automatic train stop, said: "Every inventor who has ever had anything to do with the railroads knows that it is hopeless to attempt to get the management of any railroad to assist him in any way (as by the use of track for experimental purposes) to perfect his invention, and, further, that if he submits his invention to such management he takes the risk of having the invention disclosed to signal or other companies in which the management is pecuniarily interested, which generally results in an interference in the Patent Office and a freezing out of the inventor by reason of the very heavy expense involved."

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SOCIETY MEETINGS.

Meeting of New York Electrical Society.—The 315th meeting of the New York Electrical Society was held in the new Grand Central Terminal, New York City, Dec. 19. The members were afforded an opportunity of inspecting the new passenger station of the New York Central's Railroad under the guidance of the railroad company's engineers. Special souvenir pamphlets containing illustrated descriptions of the various buildings were distributed.

* * *

Michigan Section, A. I. E. E.—Mr. J. J. Woolfenden, superintendent of engineering construction, Smith, Hinchman & Grylls, Detroit, Mich., was chosen chairman of the Detroit-Ann Arbor Section, American Institute of Electrical Engineers, at its recent meeting in Detroit. Mr. Ray K. Holland, Ann Arbor, was elected secretary, and Mr. G. W. Krause, Detroit, vice-secretary. The feature of the technical program was a talk by Mr. Holland on the new Barton dam of the Eastern Michigan Edison Company now under construction near Ann Arbor.

* * *

Joint Meeting of Milwaukee Electrical Societies Planned for February.—Plans are under way for a group meeting of Milwaukee engineering and electrical societies about the middle of February. The societies which will probably take part are the Milwaukee Electrical League, Chicago Section of the Illuminating Engineering Society, Wisconsin Engineering Society, Milwaukee Section of the American Institute of Electrical Engineers and the local members of the American Electrochemical Society. The meetings will be held at the Auditorium and it is believed that there will be a large attendance of out-of-town engineers. Mr. Francis A. Vaughn, of Milwaukee, who is chairman of the Chicago Section of the Illuminating Engineering Society, is one of those taking an interest in the projected gathering.

* * *

Plans of Chicago Jovians.—Arrangements are being made to hold a Jovian banquet at the Hotel Sherman, Chicago, on the evening of Jan. 10. Mr. George C. Richards, statesman for Illinois, assisted by Messrs. M. S. Hart, A. R. Dean, Arthur J. Selzer, C. E. Waddington, Sam A. Hobson and A. A. Gray, is making the plans. Invitations will be extended to a number of men prominent in electrical circles in Chicago. It is expected that Mr. Frank E. Watts, reigning Jupiter, will be in attendance and that addresses will be made by several other men prominently identified with the industry. At this banquet plans will be outlined for a "rejuvenation" which will be held during March as a preliminary for a monster "rejuvenation" and banquet which will be held in connection with the convention of the National Electric Light Association in Chicago, June 2 to 5.

* * *

Meter Meeting of the New York Companies' Section, N. E. L. A.—The regular monthly meeting of the New York Companies' Section, N. E. L. A., held on Dec. 16, was devoted to a discussion of "Recent Developments in Methods of Electrical Measurement, with Particular Reference to Watt-Hour Meters." Three papers were presented, all illustrated with numerous lantern slides, by Mr. W. F. Howe, of the General Electric Company; Mr. R. C. Lanphier, of the Sangamo Electric Company, and Mr. William Bradshaw, of the Westinghouse Electric & Manufacturing Company. In the discussion Mr. F. W. Smith, of the United Electric Light & Power Company, spoke briefly of his recollections of old-time meter troubles, and Mr. C. A. Littlefield, of the New York Edison Company, told some reminiscences of his early experiences with meters. It is proposed at a later date to have Mr. S. G. Rhodes tell of some of the methods of the central stations in maintaining accuracy of meters after installation.

* * *

Reunion of Former Students of Massachusetts Institute of Technology.—On Jan. 17 and 18 a general reunion of former students of the Massachusetts Institute of Technology will be held at the Hotel Plaza, New York City. The four principal events will be the departmental luncheons and the mass meeting on Jan. 17 and the class luncheon and the banquet on Jan. 18. Prof. D. C. Jackson, Prof. Elihu Thomson and Mr. Gano Dunn will address the gathering of former students of electrical engineering. At the mass meeting the plans for the new site and buildings on the banks of the Charles River in Cambridge will be discussed by President Maclaurin, Mr. John R. Freeman, '76, and Profs. Dewey, Noyes and Sedgwick. Open house will be maintained at the Technology Club, 17 Gramercy Park, during the reunion, and an informal smoker will be held on the evening of Jan. 17. Among the speakers announced for the banquet are President Maclaurin, President A. C. Humphreys of Stevens Institute of Technology and Mr. John V. Bouvier. Detailed information regarding the reunion can be had from Mr. Benjamin Hurd, chairman of the local committee in charge of arrangements, 17 Gramercy Park.

NEW TERMINAL FOR NEW YORK CENTRAL LINES

Electrical Features of the Largest Railway Station in the World, Located in the Heart of New York City and Now Nearing Completion.

Outline of Former New York Central Lines Terminal Facilities—Special Features in Construction and Arrangement of Sub-Surface Station and Buildings Within Terminal Area—Service Station for Supply of Electricity and of Hot Water for Heating.

THE monumental New York City terminal building of the New York Central lines, at Forty-second Street, Manhattan Borough, is now nearing completion. Some parts of it have been in use for a few weeks, and in January, 1913, the remaining and larger portion of the terminal building will be finished and opened to the public. The formal opening of the building will not, however, mark the completion of the work of improvement which the New York Central lines started in September, 1903, and which, when finished, will involve an expenditure of approximately $180,000,000. Buildings now in use are to be torn down and new ones erected, tracks are to be laid and new highways to be built on ground which has not been open to the public since the New York Central lines procured this tract, then farm land, for the first Grand Central Station. Within a comparatively short time, however, the work will be finished.

In addition to the terminal building, the improvements will include the erection of many noteworthy buildings upon the area between Forty-second Street and Fifty-sixth Street and between Madison Avenue and Lexington Avenue, comprising thirty-two city blocks. There will then be added to the city an entirely new section which in dignity and harmony of architecture will be unequaled in Greater New York. A new civic center with museums, hotels, clubs, theaters and high-class business buildings will be established where there was formerly only an unsightly railway yard with its smoke, dirt and noise. This transformation has been made possible only through the substitution of electricity for steam as the motive power for traction and through the extensive use of electricity for various other purposes.

PREVIOUS TERMINAL FACILITIES.

Before proceeding to the description of the new terminal and its construction, it may be appropriate to recount in a few words the history of the development of the terminal facilities of the New York Central lines in New York City.

In 1832 the first station was built by the New York & Harlem Railroad, which is now a part of the New York Central system. From this station, which was located at Fourteenth Street, the cars were drawn by horses down Center Street to City Hall, where the track ended without any terminal facilities. The next step was the building of a station in 1857 on Fourth Avenue between Twenty-sixth Street and Twenty-sevènth Street on a part of the site now occupied by the Madison Square Garden. Below Twenty-sixth Street the cars were hauled by horses, and north of this point by steam locomotives, until a short time later, when the use of steam was discontinued south of Fort-second Street.

The traffic soon exceeded the facilities at the Twenty-

Fig. 1—General View of Grand Central Terminal.

sixth Street station, and in 1871 the original Grand Central Station was built. In 1900 the station was enlarged to accommodate about 60,000 passengers daily, the number of tracks was increased and three stories were added to the building. It soon became evident, however, that a radical reconstruction was necessary to meet the increasing traffic requirements. As early as 1899 the use of electricity within the terminal was discussed, but it was not until 1903 that the objectionable atmospheric conditions in the Park Avenue tunnel and the congestion of traffic at the terminal brought about legislative action directing the complete abandonment of steam locomotives in Park Avenue south of the Harlem River within a period of five years, terminating July 1, 1908.

MAGNITUDE OF PRESENT DEVELOPMENT.

The first and principal object in erecting the present terminal was to provide a station large enough for suburban and through passenger traffic as well as mail and express service for many years to come. It is estimated that the terminal will accommodate 70,000 outbound passengers per hour and a considerably larger number of incoming passengers with a maximum of 200 in-coming and outgoing trains per hour on two levels of tracks. The whole station can take care of 30,000 people simultaneously without subjecting them to uncomfortable crowding. The plans

Fig. 2—Twenty-sixth Street Terminal, Built 1857.

for handling baggage, mail and express are on an equally extended scale.

Referring to Figs. 1, 5 and 10, it will be noted that all tracks are below the street level. Above the upper level of tracks are carried transverse streets, the center being

COMPARATIVE DATA ON THE LARGE PASSENGER TERMINALS IN THE WORLD.

Terminal.	Total Area, Acres.	Number of Tracks.	Length of Tracks, Miles.
Grand Central, New York	70	68	31.8
Pennsylvania, New York	28	21	16
Union Station, St. Louis	10.9	32	5.4
Chicago & Northwestern, Chicago	8	16	2.7
Saint-Lazare, Paris	11.2	31	3.5
Frankfort-on-the-Main	11	18	....
Waterloo, London	8.75	18	....

taken by Park Avenue, which at Forty-fifth Street is diverted to the east and west around the terminal building and extends south on an elevated structure above Forty-second Street, joining the street level of Park Avenue at Fortieth Street. A total of 1¾ miles of new streets and viaducts has been built.

Besides the terminal building proper there are in use at present several office buildings for the railroad company, the United States mail and the express companies, one building for exhibition purposes, and a plant and substation for furnishing heat, water, air and fire services as well as electrical energy. All of the remaining building areas between the street lines north of Forty-fifth Street, shown in Fig. 5, will be taken up by buildings, one hotel, one club

Fig. 3—First Grand Central Terminal, Built 1871.

building and one office building being under construction at present.

The total area of the station is 70 acres. It has sixty-eight tracks with a total length of nearly 32 miles. Comparative data in regard to the principal passenger stations in the world are given in the accompanying table.

The amount of excavated material is about 3,000,000 cu. yd. and there has been erected 118,600 tons of steel, which is over twice as much as was used in the construction of the existing subway in New York City and Brooklyn.

CONSTRUCTION.

When the work of improvement of the Grand Central Terminal was commenced in 1903 all trains entered the terminal through the four-track masonry tunnel in Park Avenue, the southerly limit of which was at Fifty-sixth Street. Thence to Forty-ninth Street the track ascended about 17 ft. in an open cut and entered an open yard, remaining at the street level to the station. The yard

Fig. 4—Grand Central Terminal, Remodeled 1900.

covered an area of 23 acres and had 11.3 miles of tracks. Vehicular traffic was carried across the yard by inclines, with a long-span truss bridge over Forty-eighth Street, and by a girder bridge over the cut in Park Avenue between Fifty-first Street and Fifty-second Street. Seven footbridges, elevated above the street level and approached by stairs, crossed the yard at as many cross-town streets.

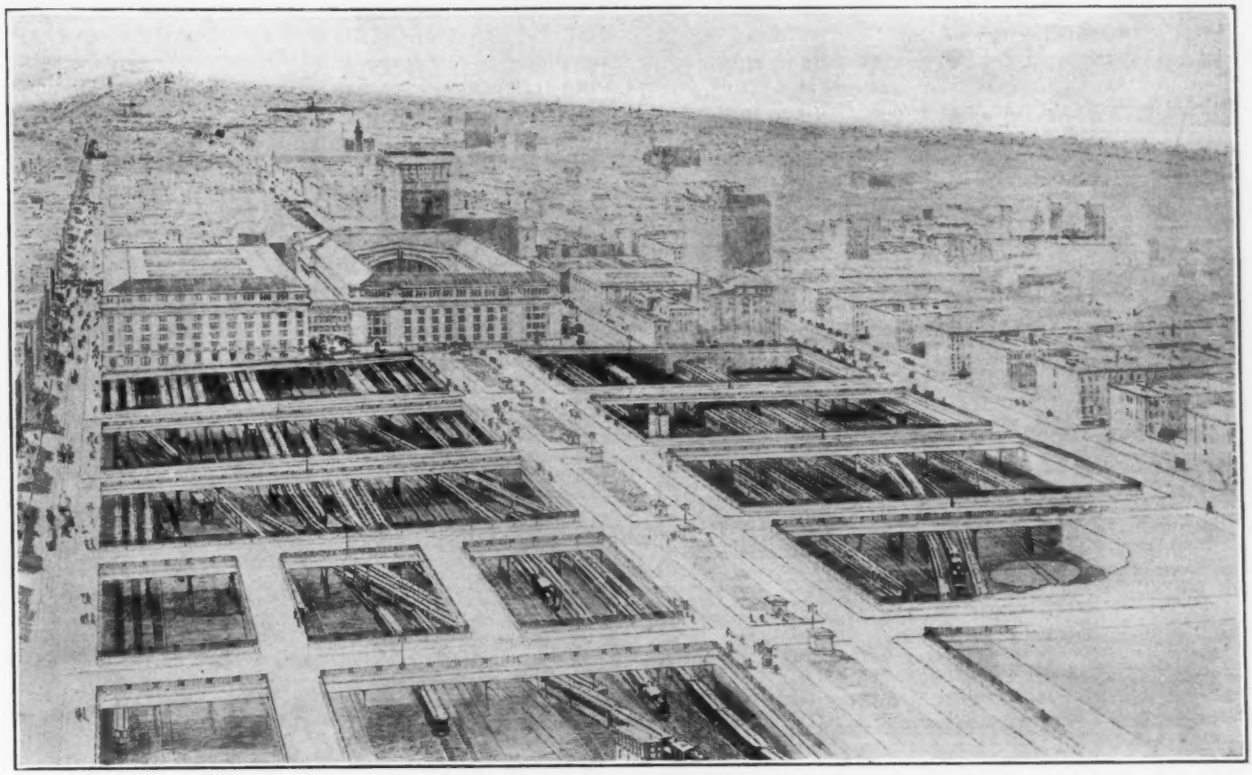


Fig. 5—Looking South from Fiftieth Street, Showing Property Available for Building Purposes Over Yards.

Fig. 6—View Showing New Tracks to the Left and Old Ones to the Right with Excavations and Erection of Steel Construction in Progress in Center.

The preliminary work in the reconstruction consisted in shifting city sewers, gas and water mains, in moving the buildings on the site of the yard extension, in removing a number of the old transverse bridges and re-erecting some of them in new positions, and in relocating and readjusting much of the switch and signal plant. It is estimated that about 25 miles of pipes and sewers were removed or re-

Fig. 7—Restaurant on Suburban Level.

placed, more than one-third of this being accomplished before general excavation was commenced in the yard.

About Sept. 1, 1903, excavation was first commenced on the west side of Park Avenue, alongside the wall of the old tunnel between Fiftieth Street and Fifty-seventh Street. This excavation was carried down to the bottom of the tunnel and two new tracks were laid. In 1904 work was commenced on the excavation of the east side of Park Avenue from Fiftieth Street to Fifty-seventh Street, where a trench wide enough for three new tracks was carried down to final grade. These excavations, which extended across the entire width of Park Avenue, were completed under considerable difficulty. Where crossovers in tracks occur it was necessary to omit the columns to provide track clearance. In some cases the tunnel roof is now supported by riveted trusses 150 ft. long and 10 ft. high. During the construction traffic was maintained on the sidewalks, which were carried over the excavation on temporary wooden trestles.

The increased number and length of the tracks in the

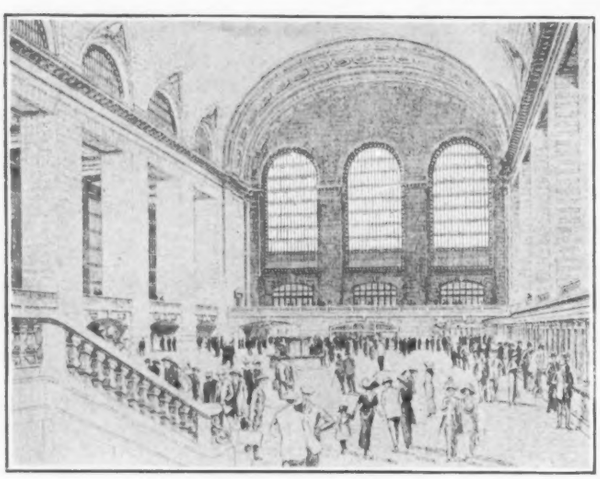


Fig. 8—Express Concourse.

tunnel increased the facilities for regular traffic and for contractors' trains carrying excavated material from the yard excavations. Storage space for contractors' trains was provided on the area west of Lexington Avenue formerly occupied by buildings. Excavation for the depressed yard between Park Avenue and Lexington Avenue was then made and retaining walls and new tracks were built within the excavated area. A temporary station had at the same time been established in an old office building at Lexington Avenue and Forty-third Street into which the suburban traffic was transferred. Excavation was then commenced in the central portion of the yard. This portion is now also finished and the work on the west side of the yard is in progress. The total excavation amounts to 3,096,750 cu. yd., about 2,000,000 cu. yd. of this being rock.

It was the original intention to transfer the traffic to the new east side station before removing the old train-shed. This plan could not be carried out because of the increase in traffic and the progress of excavation. It was therefore decided to remove the shed while train service was maintained at the old station. To accomplish this result and to reduce to a minimum the possibility of accident by falling material use was made of a traveler, the outline of which conformed to the general contour of the train-shed, spanning all platforms with heavy floors extending the entire width of the shed. The supports of the traveler rested on

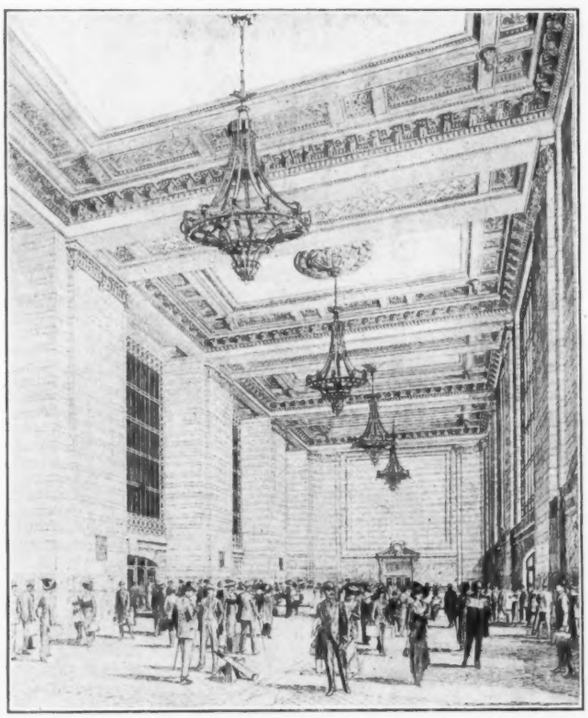


Fig. 9—Main Waiting Room.

five intermediate platforms and were carried on heavy cast-iron wheels which rolled on standard 100-lb. rails. It had a length of 65 ft., contained 370,000 ft. of lumber, 65 tons of bolts and washers and 33 tons of plates and castings and was equipped with six derricks operated by two steam engines. The traveler was first erected at the northern end of the shed and moved south toward the main building as fast as the shed was removed and replaced by temporary wooden canopies. By means of this traveler there was removed a total of 600 ft. of train-shed, containing 1350 tons of wrought iron, 350 tons of cast iron, 90,000 sq. ft. of corrugated-iron roofing, 60,000 sq. ft. of glass and 500,000 bricks, the train service being maintained in the meantime without interruption.

When all traffic had been transferred to the temporary station, the old building was torn down, excavations were made and the new structure was erected on its site.

THE NEW TERMINAL.

In designing the new terminal careful consideration has been given to the actual car and train requirements and their probable future increase, and to the necessary facilities for unloading mail, express and baggage, together

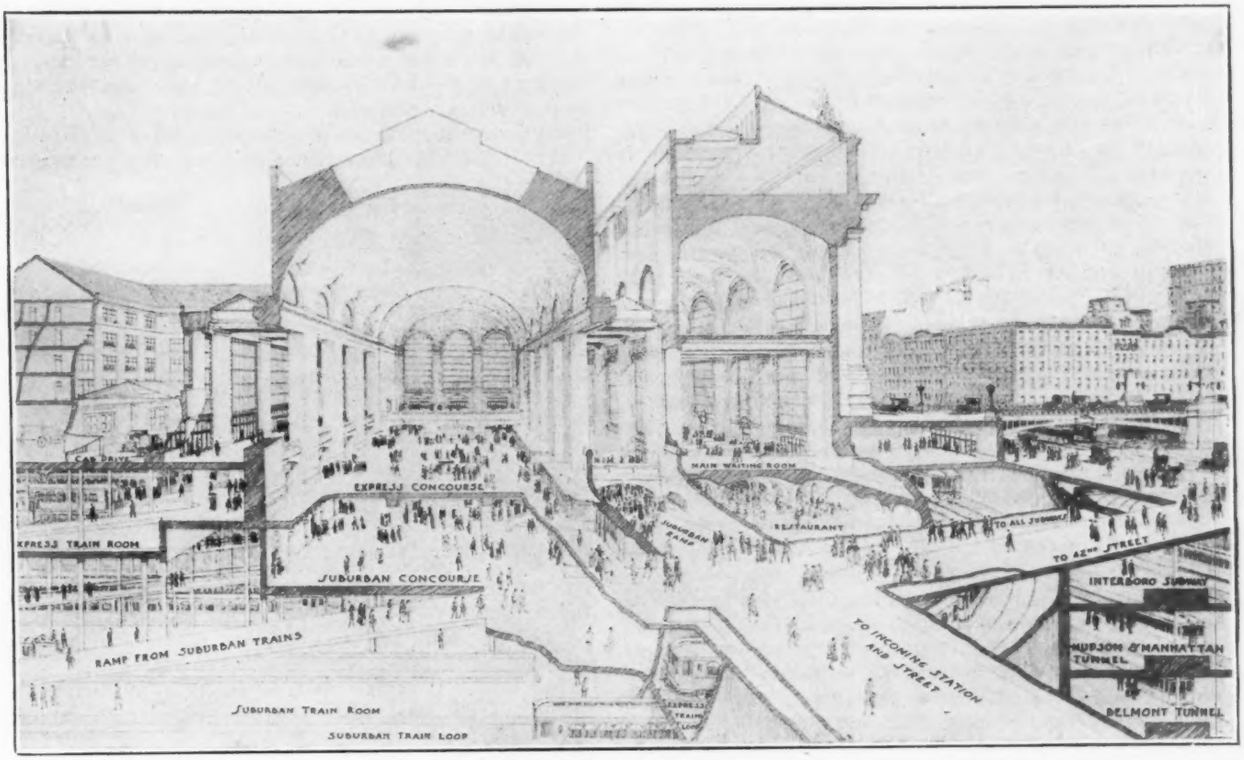


Fig. 10—Cross-Sectional View, Showing Train Room, Concourses and Waiting Rooms and Also City Subways.

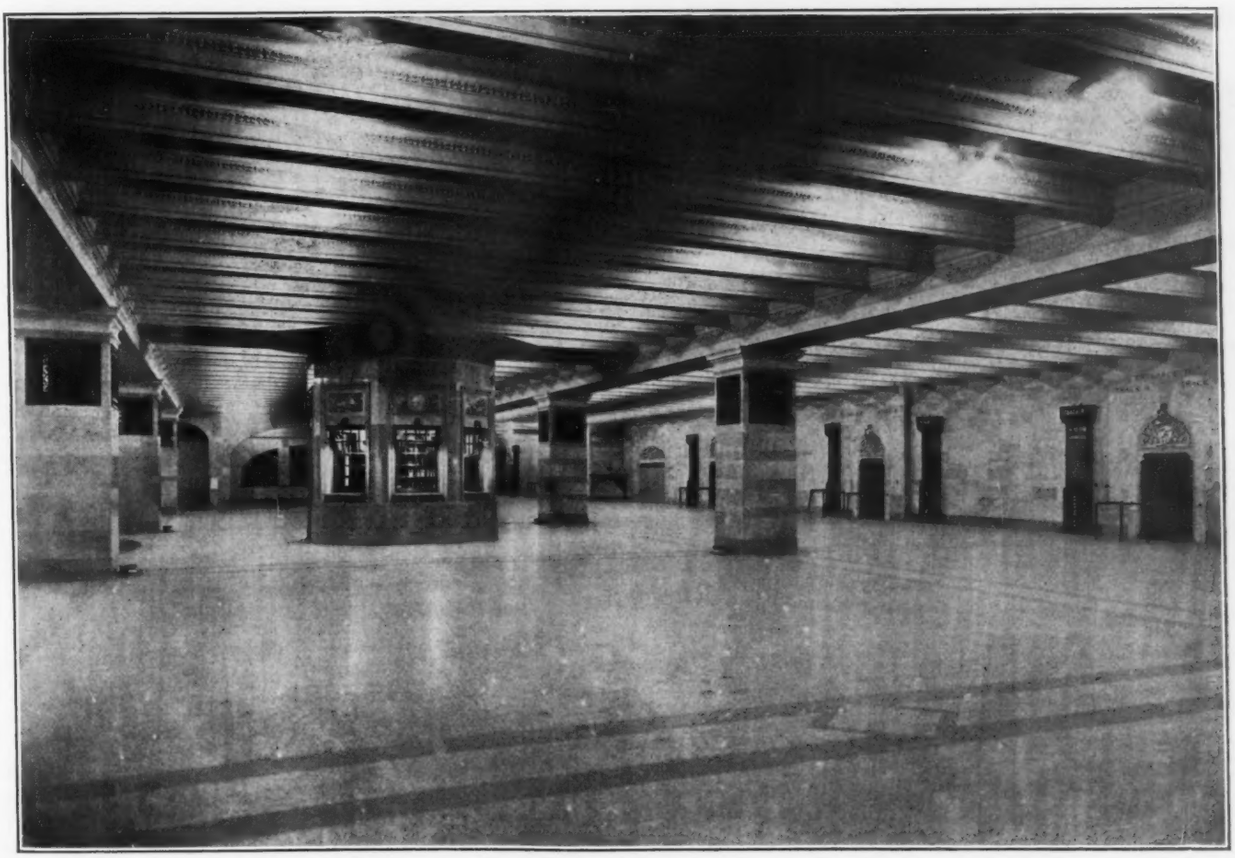


Fig. 11—Suburban Concourse with Train Gates to the Right Opposite the Inclined Way from Forty-Second Street.

with adjuncts for cleaning, stocking and preparation of equipment for the return journey. From the accompanying illustrations it will be noted that there are two levels of tracks, the upper one for express service and the lower one for local service. Underneath the lower level of tracks three transverse and two longitudinal subways are provided for transfer of mail, baggage and express, and for building and yard piping and ducts for electric feeders.

The main building extends from Forty-second Street to Forty-fifth Street between Depew Place and Vanderbilt Avenue, covering an area at the street level 301 ft. wide and 722 ft. long. Below the street level the station will be 745 ft. long and 455 ft. wide. The façade of the building, which is finished in Indiana limestone with a base of Stony Creek granite, is composed of three arches, each 33 ft. wide and 60 ft. high, supported by heavy columns and surmounted by a statuary group representing Progress, supported by mythological figures symbolizing physical and mental energy.

The principal room is the express concourse, a magnificent inclosure, 275 ft. long, 120 ft. wide and 125 ft. high. It is finished in Botticino marble and buff-tinted stone, with six large dome-shaped windows in the ceiling. Here the traveler will find all the facilities usually provided in the waiting room of a railroad station; that is, ticket offices, information bureau, parcel room, baggage-checking booth, etc. The facilities are arranged so that the movement of the traveler is a progressive one, the railroad-ticket window coming first, the sleeping-car ticket window next, then the baggage-checking office and so on. There is a total of forty-eight ticket windows. Immediately upon entering the concourse the train gates are in full view and the indicators are so conspicuous that the desired track and train can be ascertained from any part of the room. From the concourse passengers proceed to the platforms, which are reached by broad ramps of easy grade, the difference in level being only 3 ft.

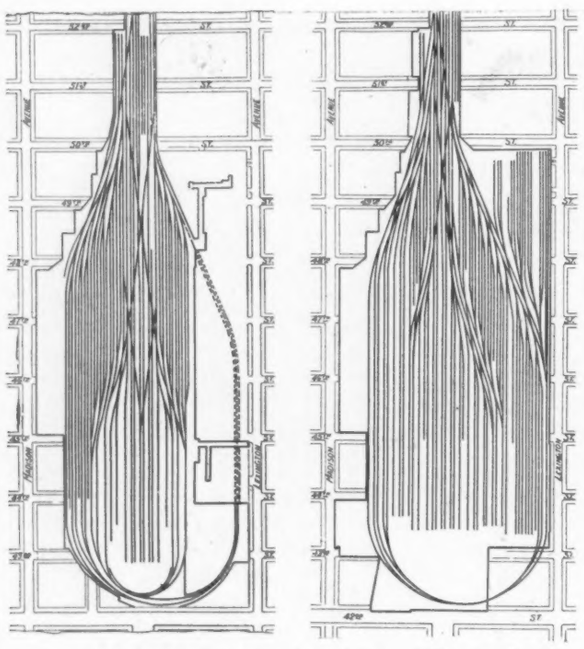


Fig. 12—Track Layouts for Suburban and Express Level Respectively.

Underneath the main concourse is the suburban concourse, which is of the same dimensions, excepting as to the height of ceiling. The interior arrangements are identical with those of the main concourse. The most striking feature of the suburban level is the main ramp from the entrance at the corner of Forty-second Street and Vanderbilt Avenue and particularly the part of the ramp from the Interborough subway level to the concourse. It is a marble corridor 40 ft. wide descending between the main waiting room and concourse. It is flanked by the great columns of the main concourse, and above are suspended five enormous lighting fixtures of bronze.

The waiting room, situated between the main concourse and Forty-second Street, is a large room, artistically treated

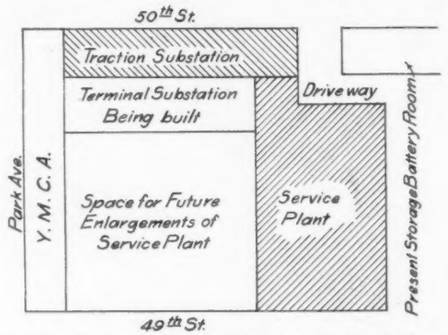


Fig. 13—Plan of Service Plants and Substations.

in buff stone and marble, and so located that it is unnecessary to pass through it in going to and from the trains, and it is thus free from the hurrying crowds. Adjoining the waiting rooms are the men's and women's rooms, barber shop, baths and private dressing rooms.

The women's waiting room is especially attractive. It has a quartered-oak floor and wainscoting and is filled with comfortable, movable chairs. Adjoining this room are a ladies' telephone room, a hair-dressing parlor and a ladies' shoe-polishing room. There is also a rest room with doctors and nurses in attendance.

Adjoining the concourse on the suburban level is the restaurant. It is an inviting room with a grotto-like effect, composed of Gustavino arches of cream-colored tile. Here, too, is a modern barber shop with dressing room.

Provision has been made for the future erection of a twenty-story office structure over the concourse of the main building when additional room is required. To provide for this building excessively large columns have been erected, some of which weigh approximately 1 ton to the lineal foot per column. Approximately 28,930 tons of steel was used in the main building.

INCOMING STATION.

The station for incoming travel now under construction is located just across Vanderbilt Avenue from the main building, between Forty-third and Forty-fourth Streets. It will have sub-surface connection with the main building, and exits to the street and subways entirely independent of the main or outbound station. It is said to be the first instance in terminal construction where the incoming travel has been provided for in a building erected especially for the purpose. The platforms are so arranged that all arriving passengers will pass a certain point in view of those who may be waiting for them. From this building there are passageways below Vanderbilt Avenue to the outgoing station and direct exits to the subway, street and Biltmore Hotel. There is a large waiting room above the express level tracks.

TRACKS AND PLATFORMS.

In the old stations the trains ran into what are known as "dead-end" tracks under the train-shed. The trains had then to be drawn back to Mott Haven, north of the Harlem River, for cleaning and to prepare them for the next trip, after which they had to be drawn again through the tunnel into the terminal. This arrangement virtually halved the possible capacity of the tunnel for passenger service.

The present arrangement of tracks for the suburban and express levels is shown in Fig. 12. The suburban level

contains a total of twenty-seven tracks. There are seventeen station tracks against platforms, two of which are reserved for baggage, and provision is made for five additional tracks west of the station tracks. The storage yards are located north of the station tracks. A loop is provided for switching the trains from the incoming track or storage track to the outgoing track.

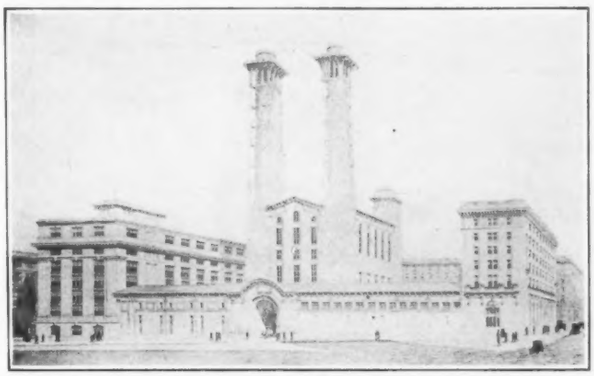


Fig. 14—Exterior of Service Plant and Substations.

The station-track construction is of creosoted yellow pine blocks placed in concrete, the rails being fastened to the wooden block by means of screw spikes.

The platforms, which are built of concrete, vary in width from 14.33 ft. to 26 ft. Passenger platforms are 4 ft. above the top of the rail so as to avoid steps to the cars, while baggage platforms are 4 ft. 3 in. above top of rail. Under the platforms arrangements are made for piping and electric conduits.

The steel columns supporting the viaducts and buildings are protected by incasing them in a concrete pier for a distance 7 ft. above the top of the rail where they are adjacent to a running track, and 4 ft. 6 in. above the top of the rail where they are adjacent to a storage track. Above the protection pier the columns and girders are insulated by using concrete placed on wire cloth.

The express level has forty-two tracks, of which six are for baggage, two for mail, three for the American Express Company, and five for storage purposes. Incoming trains will arrive on the west side at the incoming station. The track construction is similar to that on the suburban level. The first cost of this construction is heavy, but the maintenance charges are low and cleanliness is assured. Water pipes are carried under the platforms, to which hose is connected to enable the tracks to be frequently flushed.

TERMINAL SUBWAYS.

There are three transverse subways below the lower level of tracks, one at Forty-third Street for mail conveyors and baggage trucking and one at Forty-fifth Street for baggage trucking. These subways also contain piping and wiring conduits. The third transverse subway is at Forty-eighth Street and is for piping only. On the westerly side of the terminal a longitudinal pipe subway connects with the three transverse subways.

Outgoing baggage is loaded on electric trucks and lowered on elevators to the baggage subway and again raised by elevators to the platform of the designated train. By this arrangement the passenger platforms are kept free of baggage trucks.

ELECTRICITY IN THE TERMINAL.

Attention has previously been called to the important part electricity plays in this undertaking. In fact, the terminal has been made possible only through electricity. Its use for traction purposes which is undoubtedly of greatest importance will not be treated in the present article, nor will the illumination of the terminal. The latter will be described fully in a later issue.

The electric signal system installed is the largest in the United States. The controlling apparatus is housed in a four-story building which is located below the street level at Forty-ninth Street. The signal system for the suburban level is said to be the largest ever constructed and has 400 levers, each one of which operates a switch or signal. On the floor above is the system for the express level, containing 362 levers. To each forty levers a man is assigned who carries out the directions of a train dispatcher. The movement of the trains is indicated by electric lamps on a chart which is a fac-simile of the track layout of the railroad yards.

A feature is the means employed for advising gatemen on the concourse when to open the gates and admit passengers to the trains. An electric lamp is placed in the hand-rail in front of each gate, and when the train is made up and ready to receive passengers the conductor presses a button, which lights this lamp, and thus notifies the gateman. At the moment the train is due to leave the gateman closes the gate and presses a button located on the same hand-rail, which lights a lamp on the platform, notifying the conductor that the gate is closed.

All passenger elevators throughout the terminal are operated by electric motors, as are also the dumb-waiters for parcel delivery and for the restaurant. Cooking in the restaurant is performed on electric stoves, with the exception of broiling, for which there is provided a charcoal stove. The drinking water furnished throughout the terminal is filtered, ozonized, cooled and pumped by electricity. Electrically operated vacuum and compressed-air plants, refrigerators and other appliances are installed in the terminal. All the ventilating fans used for the supply of fresh air and the exhaust of vitiated air are motor-driven.

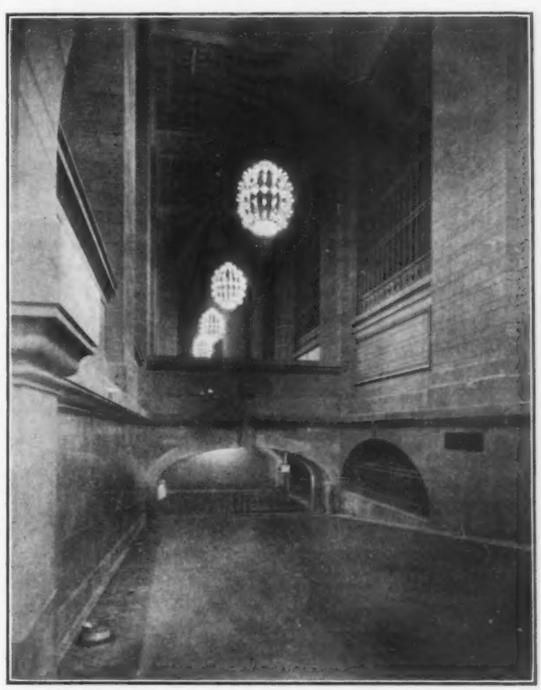


Fig. 15—Ramp from Forty-second Street to Suburban Level on the Left and Restaurant on the Right.

DRAINAGE AND PIPING.

Through a low-level sewer in Forty-sixth Street, connecting the terminal with the river, the entire area of the terminal will be drained by gravity with the exception of the three subways. Sumps are built in the latter and the water collected is raised to the sewer by centrifugal pumps automatically operated by motors. The yard is piped for

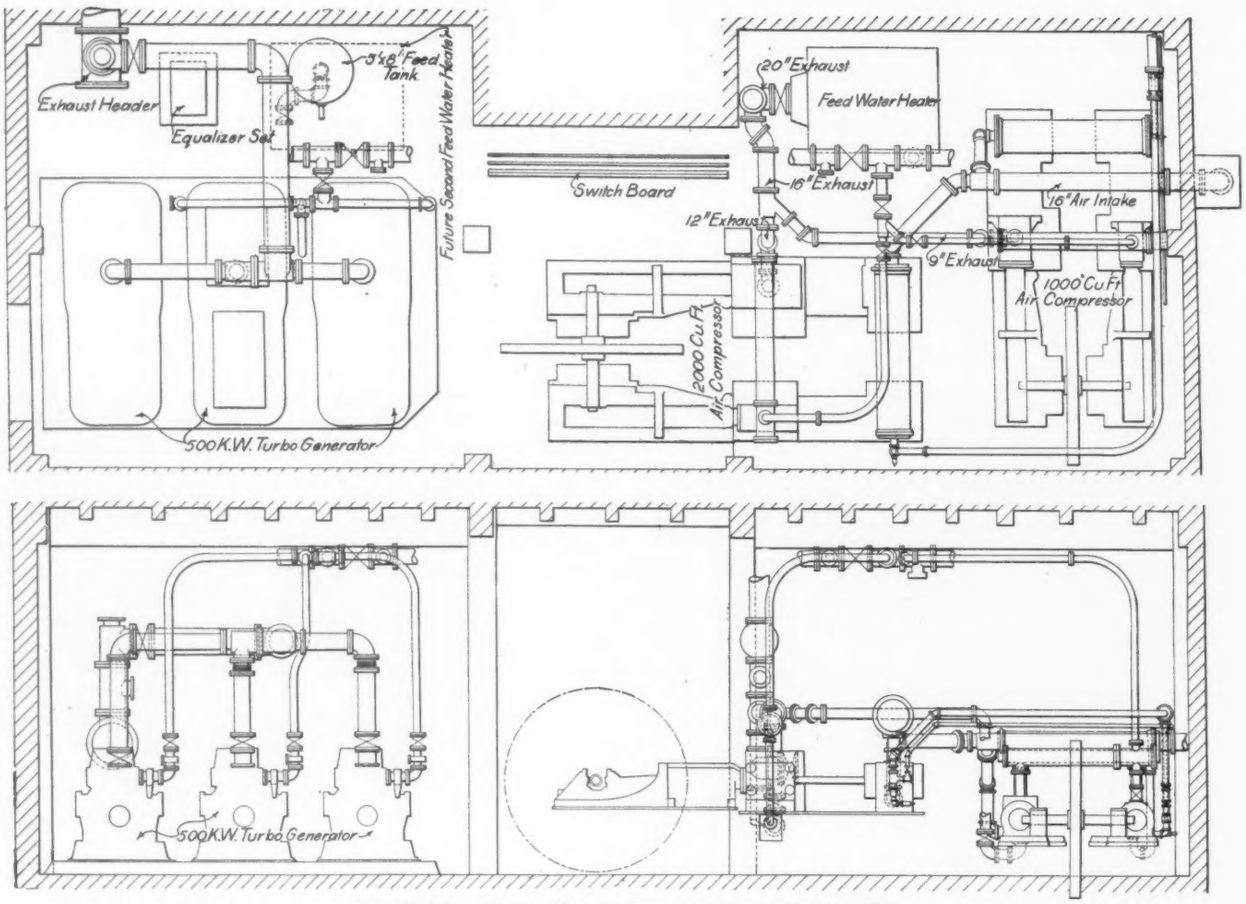


Fig. 16—Plan and Section of Engine Room in Service Plant.

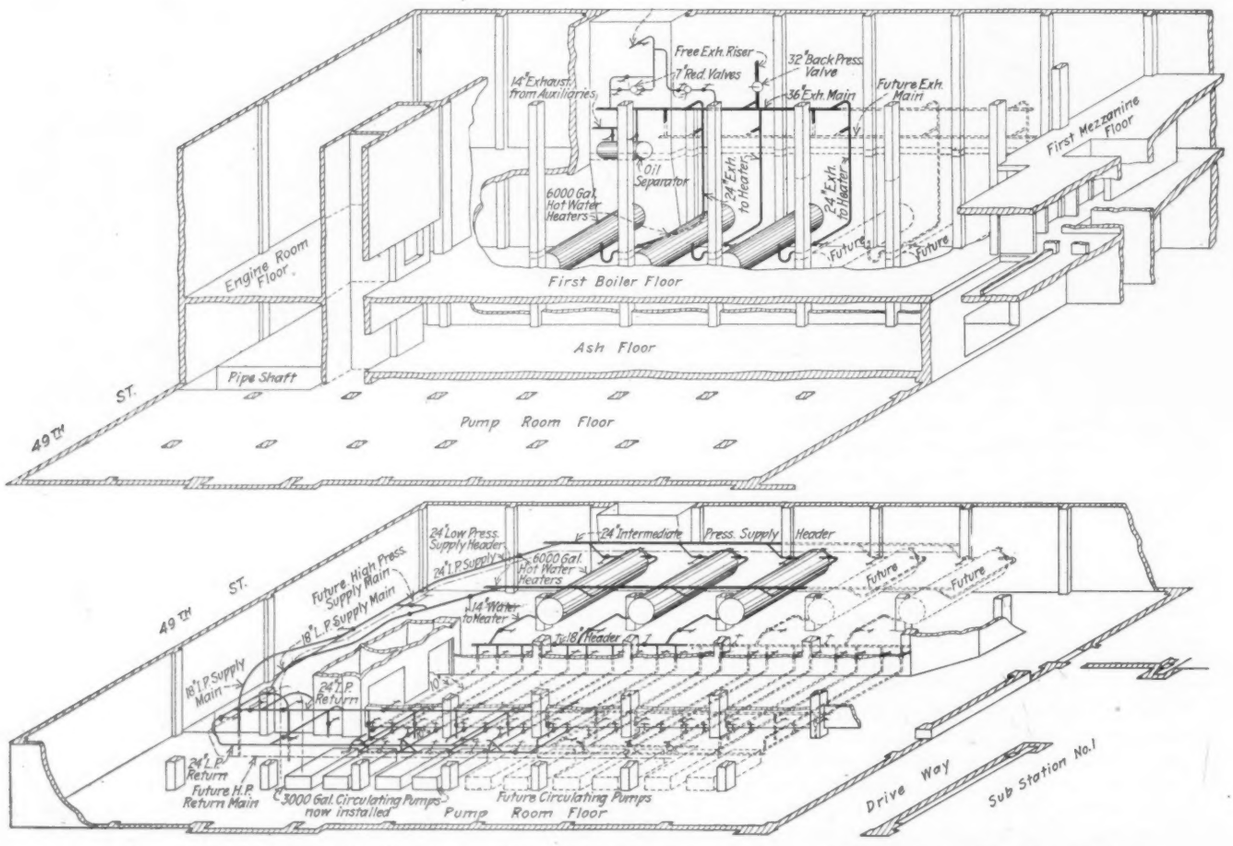


Fig. 17—Isometric Plans of Heating Equipment, Showing Steam Connections and Water Connections Respectively.

supplying hot and cold water, steam, compressed air and vacuum-cleaning connections to every car. Offices and rest rooms for employees are placed at convenient places about the terminal A complete fire-protection system is installed on both levels with nearly 300 hose connections. The fire-alarm system has 125 call boxes connected to a central point from which the city fire department may be called if required to assist the station fire department.

SPECIAL FEATURES.

An important feature in the construction of the terminal is the elimination of stairways accomplished by the use of ramps, or inclined ways. Another feature is the complete segregation of through and local inbound and outbound traffic. Separate waiting rooms and concourses for the local and through traffic are provided and a separate station for the incoming traffic, which eliminates all counter currents of travel and the confusion resulting therefrom.

The tracks are arranged on two levels, the upper for through business, the lower for local traffic, and both are connected with loops which circle around under the main building. After the passengers are unloaded, the trains are taken around the loop, the baggage cars are shunted to special baggage tracks, and the train proceeds to a storage yard, or, if it is a local train scheduled to leave within a short time, it is placed by one of the outgoing platforms.

SERVICE PLANT.

For the purpose of furnishing heat and electrical energy for lighting and motor service to the terminal buildings and other buildings within the terminal area a service plant has been constructed between Forty-ninth Street and Fiftieth Street. The building is 60 ft. long by 90 ft. wide and is of steel and brick construction, carried on steel columns above the tracks. The street level, or the first floor of the plant, is used for the removal of ashes and also provides space for hot-water-heating pumps, converters, boiler-feed pumps, elevator pumps, fire pumps, house pumps, etc.

The boilers, of which there are ten installed on the second floor, are of the water-tube type and have an aggregate rating of 6000 hp. There is space reserved on this floor for two additional 635-hp boilers, and on the third floor there is space reserved for twelve boilers of a combined rating equal to that of the boilers on the second floor. The space now used as a temporary engine room can also be used for boilers should necessity require, which would result in a total equipment of 17,400 hp.

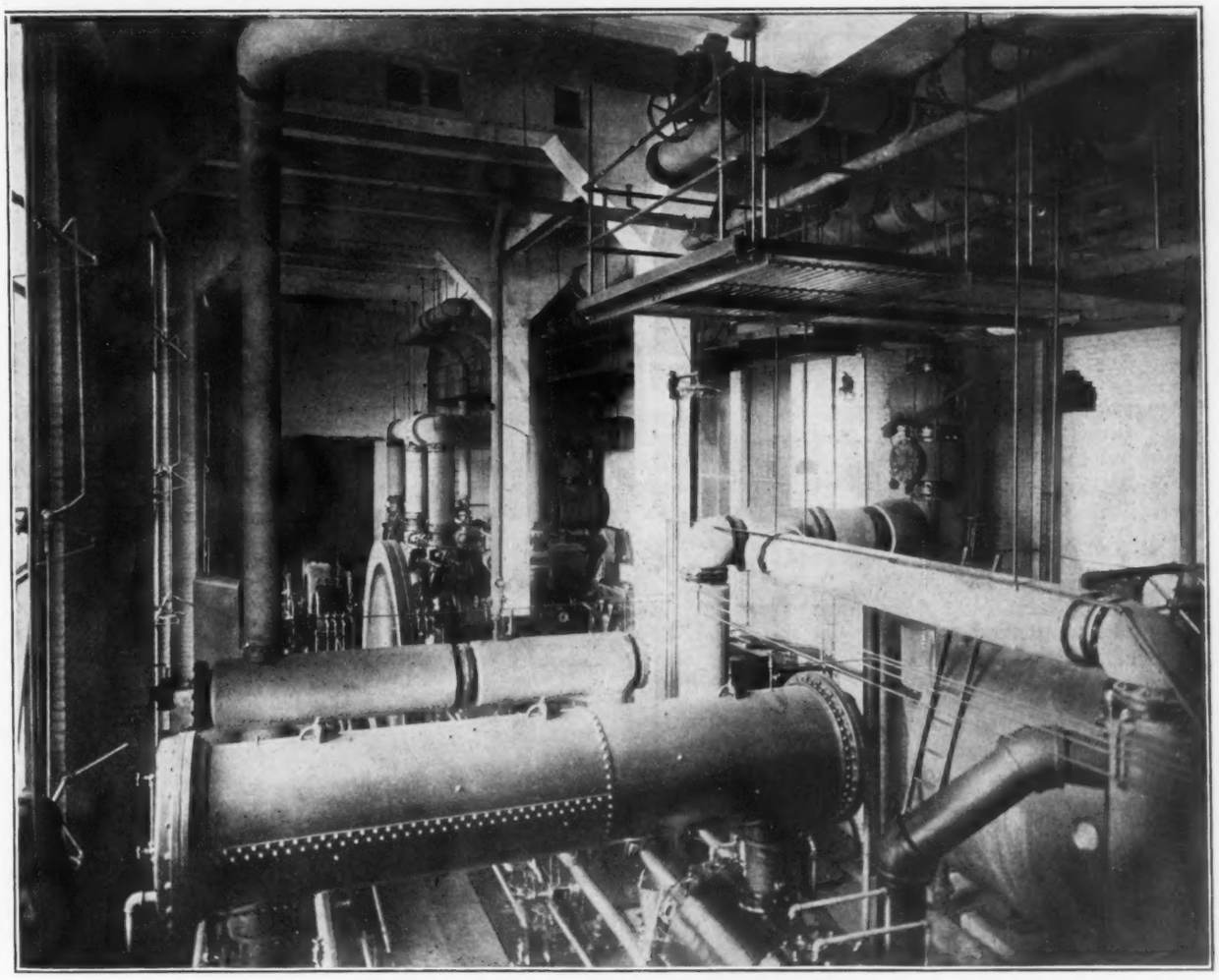


Fig. 18—General View of Engine Room of Service Plant.

Overhead coal storage bins are provided having a total storage capacity of 3000 short tons. Coal is delivered by cars on the track level or by trucks on the street level, emptying through chutes into a balanced skip hoist, which elevates the coal at a rate of 60 tons an hour to the coal bins. As soon as it has passed through an automatic coal-weighing hopper, the coal is delivered by a small belt conveyor to a horizontal distributing belt conveyor, which distributes the coal in the overhead coal bins. In addition, there is a 5-ton motor-operated crane for delivery of coal direct from wagons to boilers. For the street delivery there is a 40-ton motor-operated screw conveyor which delivers into the skip-hoist hopper.

Natural draft is provided by two steel-plate brick-lined stacks, each having an internal diameter of 17 ft. and a height of 200 ft. above the grates. Flues and intakes are of ¼-in. wrought-iron plates with 2-in. book-tile lining. Forced draft is provided by two steam-operated, 310-r.p.m. blowers. A feed-water heater raises the temperature of the feed water for the boilers.

Electrical energy for present needs is generated by three 500-kw, 275-volt direct-current machines driven by directly connected horizontal, non-condensing turbines, operating at 1625 r.p.m. and 180 lb. steam pressure superheated. The energy supply from these generators is used for motor service and during the non-heating season also for lighting. The lighting circuits are designed for 120-volt service and the motor circuits for 240-volt service.

For heating the terminal buildings hot water is supplied by two systems at different pressures and temperatures. Ultimately, when higher buildings are erected, a third system will be installed. At present the low-pressure system circulates about 3500 gal. a minute at a varying temperature, while the intermediate-pressure system circulates about 1020 gal. a minute. On a panelboard near the circulating pumps meters are mounted for recording the circulation of water in supply and return pipes and also the temperature of the water of each system. The water is heated by exhaust steam in three 6000-gal. even-flow heaters. In case the exhaust steam is insufficient for heating purposes, reduced-pressure live steam is obtained through duplicate reducing valves in the live-steam connections. For the circulation of hot water four 14-in., one-stage centrifugal pumps rated at 3000 gal. a minute are provided, each pump being operated by a directly connected, variable-speed, 170-hp motor and controlled by a starting rheostat. Space is provided for additions to the heating equipment to meet any possible demand. All buildings in the terminal area will be equipped for hot-water heating furnished from this plant.

The freight and baggage elevators throughout the terminal are of the hydraulic plunger type. Within the service plant there has been installed one 5-in., four-stage elevator pump with a capacity of 500 gal. a minute and operated by a 110-hp, 1700-r.p.m. electric motor, which is controlled by an automatic starting device of the "make-and-break" type,

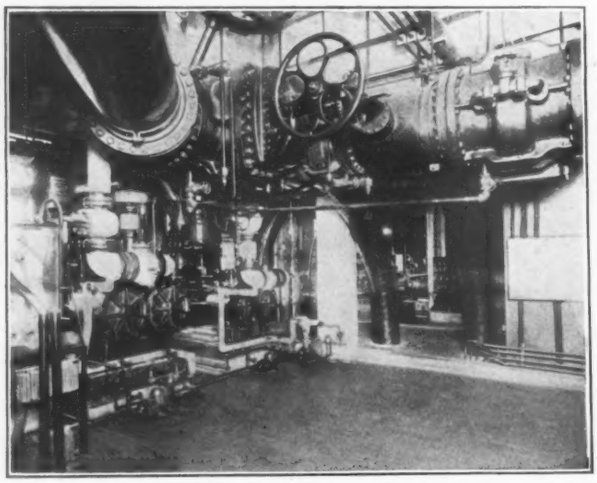


Fig. 19—Hot-Water Mains and Steam-Operated Fire Pumps to the Left.

starting the motor when the pressure in the tank is reduced to 225 lb. For the same purpose there are two horizontal, steam-operated, tandem-compound elevator pumps, each one rated at 500 gal. a minute. Space is provided for a 750-gal. pump. A duplex two-stage steam-operated air compressor regulates the pressure of the air cushion in the elevator surge tank.

For sanitary purposes there has been installed one steam-operated, tandem-compound house pump, rated at 1500 gal a minute, and for hot water in the lavatories two 4-in., two-stage, 250-gal. pumps, each operated by a 20-hp, 900/1800-r.p.m. motor, have been furnished. Two 250-gal. heaters furnish hot water for lavoratory service.

Fire service throughout the terminal is supplied from the

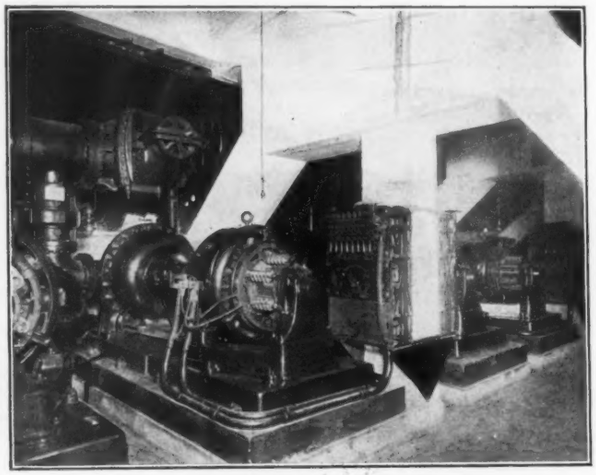


Fig. 20—Circulating Pumps for Hot-Water Heating.

service plant. For this purpose there is one Underwriters' centrifugal pump rated at 1000 gal. a minute against 150-lb. pressure, directly connected to a 135-hp, 1400-r.p.m. motor. For the control of this unit there is a control panel equipped with an 800-amp circuit-breaker, rheostat, knife switch and fuses. There are also two Underwriters' steam-operated duplex pumps, one rated at 1500 gal. a minute and the other at 1000 gal. a minute.

Condensation in piping throughout the service plant is collected by traps and carried by gravity to a tank on the first floor, whence it is raised to the feed-water heater on the second floor by means of two steam-operated duplex pumps. In addition to the above the service plant has the usual equipment of feed pumps, oil separators, etc.

A 30,000-gal. storage tank is located in the southeast tower of the building; two 15,000-gal. tanks for fire service are temporarily installed under the second-floor boiler room, and, in addition, two 4000-gal. tanks are placed on the ground floor.

Compressed air for various uses in the terminal is furnished by two horizontal air compressors driven by cross-compound Corliss-type engines. One has a capacity of 1000 cu. ft. and the other of 2000 cu. ft. of free air a minute. These are installed in the engine room on the second floor.

TERMINAL SUBSTATION.

For handling part of the lighting load a 1500-kw rotary converter has temporarily been installed in the traction substation at Fiftieth Street, which receives alternating current at 11,000 volts from the Port Morris generating station at 140th Street and Long Island Sound. The latter station was described in the *Electrical World*, Sept. 29, 1906, and the traction substation in the issue of Oct. 27, 1906. At present a terminal substation is being erected in the space immediately south of the traction substation, as shown in Fig. 13. This building will be of brick and steel construction, 112 ft. long and 40 ft. wide, and is designed to contain five 5000-kw rotary converters, which will receive high-tension, three-phase, 25-cycle alternating current from the Port Morris generating station and deliver direct current at 270 volts to the terminal system.

In the basement of this substation space will be provided for a storage battery having 150 cells and an output of 16,000 amp for twenty minutes.

EFFICIENCY OF "EARTHS" IN RADIO-TELEGRAPHY.

By Charles A. Culver.

Continuing an investigation the first part of which was reported in the *Electrical World* of Dec. 2, 1911, the writer has recently studied the relative efficiency of various forms of earth connections at the radiating station. The conditions under which the tests were made were as follows: A radiating station was erected on the Beloit College campus at Beloit, Wis., consisting of a single vertical No. 16 copper wire, 19.6 m (64.4 ft.) in length, supported by and properly insulated from an iron flagpole. This aerial was connected to a closely coupled transmitting instrument actuated by means of a ¼-kw transformer. A motor-driven circuit-breaker was inserted in the primary circuit of the above transformer by means of which signals of fairly constant value could be radiated for a period of several hours at a time. A square galvanized-wire screen of ¼ in. mesh, measuring 61 cm on a side, was buried in the earth at a depth of 18 cm and served as a standard earth. The radiating system, when connected to this or to the various earth connections referred to later, was carefully tuned by means of a delicate ammeter to the fundamental of the oscillating system. The wave length when connected to standard earth connection was approximately 275 m.

The receiving station was set up at the College Athletic Field, an approximate distance of 1.2 km from the campus station, and consisted of a single vertical wire 9.5 m long connected to a loosely coupled transformer and silicon detector. A piece of wire netting laid upon the grass served as earth connection. The shunted telephone method was employed in measuring the incident energy.

The radiating system was connected to various types of earth connections and the efficiency of a given arrangement was determined by noting the relative amount of energy that reached the receiving station. A piece of wire netting of the same dimensions as the standard earth connection when laid upon the grass showed, in a number of tests, a relative efficiency of 100 per cent. In one or two tests it proved to have an efficiency of approximately 75 per cent. The above piece of netting when supported on two-shed porcelain insulators 18 cm above the ground gave a mean relative efficiency of 65 per cent. A galvanized-iron pipe, 2.5 cm in diameter and 80 cm long, driven vertically into the ground, showed a relative efficiency in a number of tests of 100 per cent, but in one or two instances the efficiency fell to approximately 75 per cent.

The efficiency of an earth connection consisting of 30 m of No. 16 copper wire laid upon the grass proved to be a function of its direction with respect to the receiving station. The resonance curve when employing such a connection was very flat, rendering the measurements difficult to make. However, in all positions such an earth connection proved to be relatively inefficient when compared with the types above mentioned. It was found that when an earth wire was laid upon the grass in such a position that it pointed directly away from the receiving station it had a relative efficiency of approximately 10 per cent. When in a position at 90 deg. to a line joining the two stations the efficiency was somewhat higher, approximately 15 per cent. When the earth wire pointed directly toward the receiving station the relative efficiency proved to be about 20 per cent. All of the above-mentioned tests were repeated a number of times under varying weather conditions, though in general it should be said that the ground was fairly moist. As was to be expected, the numerical values varied somewhat from day to day but the general results were as already stated.

In addition to the above experiments further tests were carried out in a preliminary way, in order to determine the feasibility of utilizing a continuous metallic conductor as an earth connection between stations. A radiating station, similar to the one described above, was set up near a street-car track and about three blocks distant from a receiving station. Tests were made to determine the relative amount of energy reaching the receiving station when using pieces of wire netting as earth connections and when both stations were connected to the rails. Although no special effort was made to make perfect contact with the rails, and notwithstanding the fact that the earth was very wet owing to recent heavy rains, the energy reaching the receiving station when both stations were connected to the same rail was approximately twice as great as it was when both stations were utilizing netting as earth connections. It is our purpose to conduct further and more careful tests along this line.

The results of the tests herein recorded and those reported in the previous paper tend to show that, in general, there is little difference in the efficiency of metal plates, nets or vertical solid conductors when buried in or laid upon the surface of the earth. This apparently holds true for both radiating and receiving stations, with the possible exception of the wire net when insulated from the ground at the oscillator. However, when employing such a balancing capacity the resonance curve is more sharp than with the other forms of earth connections tested, due doubtless to the diminished damping. The possibility of sharp tuning might in this particular case compensate for the lower gross efficiency value.

When, however, one considers the case of wires used as earth connections the problem presents interesting and important variations. At both the radiating and receiving stations an earth wire exhibits a directive effect, this being particularly true with the receiving system. The maximum efficiency apparently results when the wires point toward the corresponding station. Upon referring to the previous paper it will be seen that at the receiving station an earth wire several times the length of the aerial shows a decidedly higher efficiency than the other forms of connections tested, while at the radiating station the use of such a wire shows a very low efficiency. The natural conclusion, from an engineering point of view, would be that where a given station is to be utilized for both receiving and radiation it would be better practice to combine the two types of earth connections; that is, to install a metallic plate or grid in contact with moist earth and in addition to this to arrange one or more earth wires of as great length as local physical conditions will permit. Further, if the suggested earth-wire system were so arranged that it could be independently connected to the aerial system when being employed to receive signals, one could not only intercept a greater amount of energy than when utilizing the common form of earth connection, but by a suitable arrangement of parts it ought to be possible to determine the approximate direction from which the signals were being radiated. In short, it would appear to be possible to design a radio-goniometer based on the operation of the earth wires rather than upon the functionating of the aerial wires as in the Bellini-Tosi system.

Aside, however, from the practical aspects of the above facts, the theoretical questions involved in the unlike behavior of the two stations when operating with earth wires are worthy of careful consideration. A satisfactory explanation of this and related phenomena is, however, not probable until further data are at hand. The preliminary experiments of connecting to an iron rail and other tests of a similar character performed by the writer in 1907[1] tend to show that signaling along a railway system might possibly be carried out with the expenditure of a comparatively small amount of energy.

As a whole the experiments described above, together with those of True[2] and Kiebitz,[3] tend to show that that part

[1] *Physical Review*, September, 1907.
[2] *J. d. Drahtl. Teleg.*, November, 1911.
[3] *Electrician*, March 8, 1912.

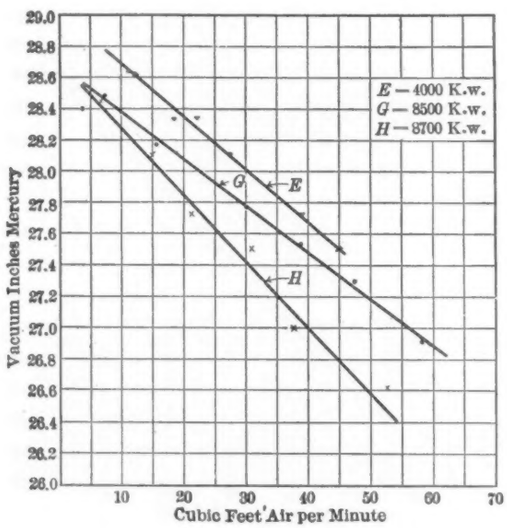
of a radio-telegraphic equipment which forms the earth connection is of equal importance with the aerial part of the oscillating system. In attempting to set electric waves in motion over or in the earth's surface we are dealing with a non-homogeneous conductor of practically infinite extent and having in general a comparatively high resistance. An appropriate consideration of these facts may in time profoundly modify our existing views of the propagation of electric waves.

EFFECT OF AIR ON CONDENSER OPERATION.

From some extended studies of the quantity of air entrained in feed-water and prime-mover exhausts, measured by fixing the free oxygen chemically, Mr. George A. Orrok, mechanical engineer of the New York Edison Company, presented the following results before the A. S. M. E. meeting at New York, Dec. 4, giving the percentage of air by volume obtained at atmospheric pressure:

	187 deg. Fahr.
Mechanically entrained in feed water, average of ten tests.....	0.0151
In solution in feed water, average of ten tests.....	0.9160
Total air in feed water from open heaters.....	0.9311
	52 deg. Fahr.
In solution in Croton water, average of three samples.....	4.325
	80 deg. Fahr.
In solution in hot-well water, average of four tests.....	0.269

These results show that Croton water gives off most of its dissolved air in passing through the open heaters, the



Effect of Air Leakage at Constant Load.

amount of air occluded in the feed water (0.931 per cent) being comparatively small. The fact is thus established that very little air came into the condenser from the feed water. There is, also, little chance for further leakage between the pump and the last condenser stage, since the system is under pressure up to this point.

To ascertain the effect of known quantities of air on the vacuum, orifices of various sizes were installed at the top of the condenser so that the introduced air might mix with the incoming steam. The amounts of air entering the condenser were checked up by the air delivered into the air bell from the air pumps. The results are shown by the accompanying curve.

The air discharged by the dry air pump at atmospheric pressure and temperature from units of 5000 kw to 20,000 kw rating varies from 1 cu. ft. per minute when the units are in the best condition to 15 or 20 cu. ft. where ordinary leakage is present, and to 30 cu. ft., or perhaps 40 to 50 cu. ft., where the units are in very bad condition.

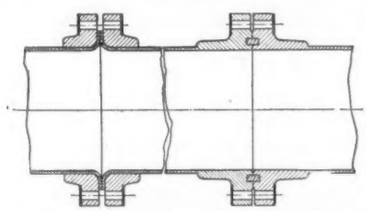
Most of this leakage comes into the condenser and exhaust passages through minute leaks in the cast-iron shells, gaskets and expansion joints. It is exceedingly difficult to detect these leaks with a candle flame, but most of them may be located by filling the condenser with warm water under a slight head. That portion of the leakage occurring in the dry air pump and piping may be detected by the shut-off test on the pump. The volume of this leakage is larger than generally supposed and is much larger when the pump is warm.

During the foregoing experiments, in which four different kinds of dry air pumps were investigated, it became evident that the volumetric efficiency of a pump working between ¼ lb. and 15 lb. absolute is very poor indeed. The difficulties of keeping valves, pistons, glands and packing tight against such a tenuous fluid as air at vacuum pressures are of much greater moment than is usually believed.

DESIGN OF HIGH-PRESSURE STEAM MAINS.

During the past three years there has been a marked improvement in the design of pipes, fittings and valves used in modern high-pressure steam installations. These improvements became necessary because the higher steam pressures and temperatures now in common practice greatly increased the mechanical strain on the piping, thereby rendering the maintenance cost of the older systems prohibitive and greatly decreasing the reliability of the plant.

In laying out mains for the high temperature of superheated steam, the engineer is practically limited to two suitable joints, that is, the Van Stone type and the welded flange. Each of these has its advantages and both are used in the most modern systems. In making the improved Van Stone joint, the end of the pipe is first reinforced by welding a collar on the outside; the end is then belled out and faced



Design of High-Pressure Steam Mains.

on both sides. A disadvantage of this type of joint pointed out by the committee on steam turbines of the Edison association is the V-shaped depression at the point where two pieces of pipe join. This acts as a small water pocket and in time through continued expansion and contraction destroys the gasket and develops a leaky joint.

A joint having a welded flange of the same inside diameter as the piping, and with grooves in the faces of each flange containing a ring, when properly made will hold good for the life of the pipe and render repairs practically unnecessary as no water can come in contact with the gaskets.

Some engineers recommend that every fitting possible be omitted from steam lines and welded nozzles substituted. The latter may be placed in any position or angle, and by the elimination of flanges they serve to decrease the weight of the piping system greatly. They are certainly much more flexible, and by their use from 50 per cent to 75 per cent of the joints ordinarily thought necessary may be omitted. The method of construction, however, is very expensive, as it requires more accurate machine work and careful erection, but when once installed it needs practically no attention. Its increased use is doubtless due to recent developments in electric welding which have rendered it possible to make each weld as strong and as reliable as any other portion of the piping system.

Central Station
Management, Policies and Commercial Methods

SOME CENTRAL-STATION EPIGRAMS.

Novel and epigrammatic "slogans" indicate the spirit of co-operation which exists between the Kentucky Electric Company, of Louisville, Ky., and the local newspapers. Col. Robert E. Hughes, president of the "Ky-El-Co," is a veteran newspaper man, as is also his assistant, Mr. C. C. Ousley, and the "slogans," which were first introduced upon the happy occasion of the press dinner tendered the newspaper representatives when the company christened its new electric building, have become part of the advertising of the central station.

Three of the leading newspapers in Louisville are the *Courier-Journal,* the *Herald* and the *Times.* The greetings extended by the Ky-El-Co to the fourth estate are couched in the following terms: "We herald the night as the *Herald* heralds the day"; "The courier of the light welcomes the fellows from the *Courier* of the news," and "We are for good times at all times for the *Times.*" In another part of the exhibition room, where motor-driven ice-cream freezers are exhibited, is the trenchant phrase: "Electric ice cream —'sleet off the trolley.'"

PRESENCE OF MIND IN SAVING A LIFE.

While installing some transformers at Bartholomew's brewery, Rochester, N. Y., Toby Martin, the company's electrician, came in contact with a switch carrying 440 volts alternating current. His hands contracted about the connection, rendering him powerless to let go or to make an outcry. Ray Flaherty, of the Rochester Railway & Light Company's wiring staff, working near by, saw the unfortunate man's plight and first tried to pull him away. Failing in this, his presence of mind came to the rescue, and, grabbing up a wooden step-ladder, he struck Martin a heavy blow across the legs, removing their support so that in falling Martin's hands were pulled clear of the contact. Martin fell to the ground apparently lifeless, but Flaherty immediately began the prone method of artificial respiration and in a few minutes the victim regained consciousness. Flaherty has received deserved congratulation both on his coolness of action in freeing Martin and on his endurance in resuscitating the injured man. All employees of the Rochester company practise the prone method of artificial respiration once a month, and this familiarity with resuscitation resulted in the practical and timely application above noted.

EMPLOYER AND MAN.

A serious difficulty created by the substitution of the big concern for the small employer, as pointed out by Mr. A. Hugh Seabrook, general manager of the St. Marylebone plant, London, England, in a recent discussion, is the tendency of the big employer to lose touch with his people. Too often he degenerates into a thing not of flesh and blood, but an intangible entity.

It will not add to the general efficiency if the employee becomes accustomed to regarding his employer as some unapproachable person who takes no personal interest in him or his welfare and practically does not know of his existence as an individual.

There should not be a gulf between the manager or sub-manager and the workman. Each is an indispensable unit—of varying importance, it is true, but, all the same, indispensable—in the scheme of organization, and where this fact is realized it almost naturally follows that a spirit of co-operation arises between the various units. If managers only realized that each man is, or should be, an expert at his own particular employment, it would result in a mutual respect between officer and man which in many cases is sadly wanting.

Appreciation of service is one of the most important factors bearing on individual and, consequently, general efficiency. It is where the big concern, and especially the municipally managed concern, is so liable to failure. In businesses where appreciation is absent the worker is soon turned into something resembling an automatic machine, mechanically entering and leaving the works or office and doing a set amount (usually the least possible) in as long a time as possible.

He becomes a clock watcher, and it is by no means all his fault; it is chiefly the fault of the system of management.

Too often one sees the effect of continual inappreciation and discouragement upon once competent men in big positions. They gradually get into the way of doing just sufficient to hold their positions and no longer take any initiative or make suggestions of any kind, because their spirit has been killed by discouragement.

DENVER EXHIBIT OF ELECTRICAL APPLIANCES.

As will be seen by inspection of the accompanying pictures, which represent views in the salesrooms of the Denver Gas & Electric Light Company, the recent exhibit which that company made of the industrial and household uses of electricity was of an unusually interesting character. This exhibit, which was shown in the handsome building of the company, followed an exhibition of industrial gas appliances which also aroused considerable interest.

In the exhibit which is illustrated the electrical applications shown were numerous and varied. The spectator saw on one hand a mercury-arc rectifier in operation, charging a

Fig. 1—Salesrooms of Denver Company.

storage battery. Not far distant was an electric potato peeler, which is something of a novelty. By co-operation with a Denver manufacturer of garments the machinery used in the making of men's clothing was shown in operation in a show window, everything being driven by electric motors. With the products of this show-window factory a regiment of 1620 men could be equipped in a week or ten

days. Other devices shown in operation were ice-cream freezers, vacuum cleaners, washing machines, ironing machines, mangles, etc.

A particularly interesting display was that of an electric pumping plant, which shows how the Northern Colorado Power Company has recently reclaimed 25,000 acres of land by installing electric irrigating equipment of this nature

Fig. 2—Denver Exhibit of Appliances.

under practical working conditions. A miniature Colorado ranch attracts much attention; here the tiny alfalfa, potato and other fields, as well as the orchards, are shown under irrigation, the water being pumped by electricity.

Motion pictures are displayed afternoon and evening, one of the films being that shown by the Westinghouse Electric & Manufacturing Company at the Seattle convention of the National Electric Light Association last June. This represents the equipment of the average American home with various electrical conveniences. Another set of motion pictures displayed by the Northern Colorado Power Company shows a pumping plant in operation.

The industrial and domestic electrical exhibit of the company attracted throngs of people to the company's salesrooms from 10 a. m. to 10 p. m. It is believed that the advertising value of these special exhibits is most important, while a fairly satisfactory number of actual sales has been recorded. Following the industrial exhibit it is planned to hold another, demonstrating the various styles of illumination, with beautiful lamps, fixtures, window displays, electric

Fig. 3—Refrigerating Equipment.

signs, special designs in flashing effects, etc., in many varied and attractive forms. This exhibit, beginning early in December, will last until New Year's, including the holiday season. Mr. Clare N. Stannard, the secretary and commercial manager of the company, is planning on making a very attractive exhibit, introducing many novel effects which it is hoped will stimulate the Christmas sales of electrical appliances. The exhibits so far held are thought to be very beneficial to the company, one result being that the building and salesrooms are made a place of popular resort, enabling the company to demonstrate its electric service in a great variety of ways. The enterprise shown by the company seems to be appreciated by the public and causes favorable comment.

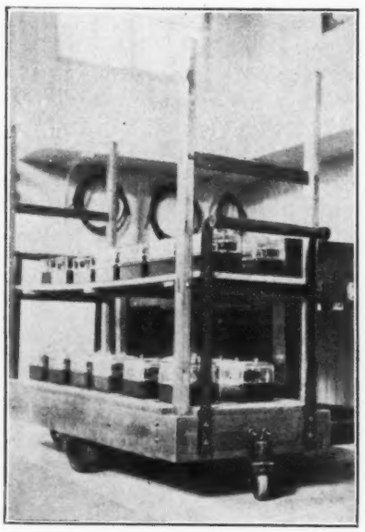
DIFFUSING RESUSCITATION KNOWLEDGE AT DAYTON.

Copies of the National Electric Light Association's rules for resuscitation from electric shock have been placed in the hands of every policeman and fireman in Dayton, Ohio, through the good offices of the Dayton Lighting Company. Charts and chained copies of the booklets have also been put up in various public offices about the city, so that the rules may be instantly available for reference in case of emergency. Other copies have been placed in the public schools, manual-training establishments, Y. M. C. A., and similar places of public resort where need for the rules might arise. In addition to circularizing Dayton with the resuscitation instructions as above, the company further contemplates placing charts in hotel lobbies, railway stations, car-stopping points, etc.

President F. M. Tait of the Dayton company recently offered to members of the N. E. L. A. the suggestion that each company mail copies of the resuscitation charts and booklets to physicians in its community. If this were done, it should prove an effective method of directing the attention of the medical profession in all parts of the country to the merits of the Schaefer method of resuscitation.

A LABOR-SAVING METER TRUCK.

The accompanying illustration shows a meter truck which is in service at the laboratory of the United Electric Light Company, of Springfield, Mass., the equipment being a home-made means of facilitating the handling of meters between the shelves of the company's stockrooms and the testing department in the basement of the headquarters offices. The truck is 5 ft. 6 in. long by 2 ft. wide and is built with double shelves, its carrying capacity when loaded being forty-two meters. The frame is mounted on rubber-tired wheels and is equipped with substantial grab-handles bolted to the base of the truck with iron straps. The use of rubber-tired wheels enables the truck to be run about at reasonable speed without endangering the moving elements of the meters or their suspensions. Since the installation of the truck it has been found that meters can be handled much more rapidly and at less expense than was possible by means of the old and burdensome method of carrying them by hand from the stockrooms to the testing department or other parts of the laboratory where they might be needed.



Rubber-Tired Meter Truck.

SELLING ELECTRIC CHRISTMAS TOYS.

An elaborate plan of featuring its new Christmas toy department, fully stocked with all things electrical, has been commenced by the Kentucky Electric Company, of Louisville, Ky., and is attracting widespread attention in the Gateway City. In its new office building the company has installed a complete assortment of trains, automatons, etc., the plan being that this department shall show a direct sales profit, since, in matter of fact, the consumption of electricity traceable to the use of the toys will scarcely be sufficient to justify their sale at cut rates. The feature of the present Yuletide exhibition is a miniature city block rigged up with electric toys. There is a street-lighting system, a toy moving-picture theater realistically outlined in incandescent lamps, a surface railway threading the thoroughfares, and an interurban line serving the "residential heights" which overlook the "business district." Another window of the building is occupied by a display of domestic appliances, chafing dishes, toasters, etc.

DISPLACING STEAM POWER IN A GENERAL MACHINE SHOP.

In connection with the introduction of the motor drive into a small general machine shop in its territory, the Worcester (Mass.) Electric Light Company recently made an analysis of the cost of power, comparing the yearly operating expenses and fixed charges under steam service with those estimated under the electric drive. The work was done by the power engineering department of the company, which indicated the engines and prepared plans showing the desirable location of machines and motors. The group drive was recommended for the installation in question, the estimated cost of the change being but $607. Although only a few motors were required, the case illustrates the value of taking all the factors of interest, depreciation, fuel and labor cost into account in endeavoring to secure business of this kind, and the methods employed are along lines useful in a great variety of installations. The results of the survey showed that, taking all costs into account, the plant could be operated for $143 less per year by electricity than with steam, and the manufacturer signed a contract on the strength of the analysis.

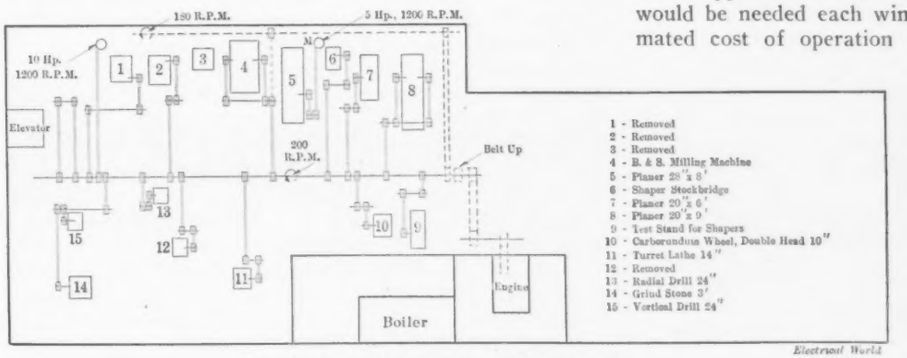


Fig. 1—Ground-Floor Plan of Machine Shop.

The plant was formerly operated by an engine the average load of which determined by indicator cards was 15.3 hp, with a probable maximum of 25 hp. The cost of this engine was $900, and that of the steam boiler for power and heating was $600. The plant was operated by one attendant at $15 per week, and the cost of coal delivered at the boiler was $4 per ton. The yearly cost of operation was determined to be $1,664.80, including fixed charges, the items being: Interest, depreciation and repairs, 15 per cent, $225; coal, 155 tons at $4, $620; engineer, $750; oil, waste and ash removal, $40; feed water, 29,800 gal., at 0.001 cent per gal., $29.80; total cost, steam operation, $1,664.80.

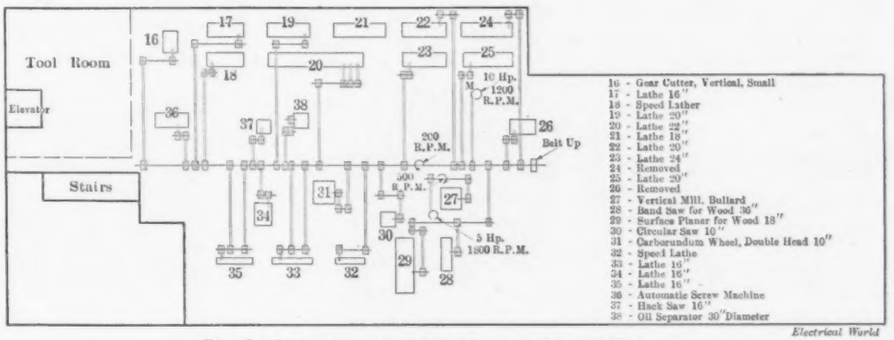

Tool Room
Elevator
Stairs
10 Hp. M. 1200 R.P.M.
200 R.P.M.
500 R.P.M.
5 Hp. 1800 R.P.M.
Belt Up
16 - Gear Cutter, Vertical, Small
17 - Lathe 16"
18 - Speed Lather
19 - Lathe 20"
20 - Lathe 22"
21 - Lathe 18"
22 - Lathe 20"
23 - Lathe 24"
24 - Removed
25 - Lathe 20"
26 - Removed
27 - Vertical Mill, Bullard
28 - Band Saw for Wood 36"
29 - Surface Planer for Wood 18"
30 - Circular Saw 10"
31 - Carborundum Wheel, Double Head 10"
32 - Speed Lathe
33 - Lathe 16"
34 - Lathe 16"
35 - Lathe 16"
36 - Automatic Screw Machine
37 - Hack Saw 16"
38 - Oil Separator 30" Diameter
Electrical World

Fig. 2—Arrangement of Machines on Second Floor.

With the exception of two machines, the group system of driving was advised, and the arrangement of motors and shafting recommended was as shown in the accompanying drawings. Six of the machines have since been removed, but the remainder are indicated by numbers on the drawing and the size and type of each machine are shown in the accompanying table. In general, the machines included millers, shapers, drills, lathes, planers, saws and other equipment used in machine-shop service.

The motors required were four in number, including a 5-hp outfit running at 1200 r.p.m. and belt-connected to the 28-in. by 8-ft. planer, machine No. 5, on the first floor; a 10-hp motor wound for the foregoing speed for main shaft driving on this floor; a 5-hp, 1800 r.p.m. motor, belted to a Bullard vertical mill, and a 10-hp, 1200 r.p.m. motor, for general shaft driving on the second floor. The estimated cost of the two 10-hp motors was $176 each, the planer motor costing $90 and the mill motor $65. The installation of the motor drive rendered advisable the disconnection of the shafting and belting shown in dotted lines in Fig. 1, thus improving the mechanical conditions and offering a means of power economy.

Arrangements were made for heating the plant by low-pressure steam from the boiler through a direct connection, and it appeared from the investigation that 40 tons of coal would be needed each winter for this purpose. The estimated cost of operation with electricity was: Interest, depreciation and repairs, 15 per cent, $91; energy at $89.10 per month, $1,070; coal for heating, 40 tons, at $4, $160; labor, 200 days at $1, $200; total cost electrical operation, $1,521.

The investigation showed that even in a small plant a careful study of costs will frequently indicate economies in the use of the electric drive, where the heating costs and all charges are taken into account. The fixed charges under electrical operation might well be below those with steam expressed on a percentage basis, but even allowing the same rate, the motor drive showed a saving on the total. The collateral advantages of the electric drive, and notably the manufacturer's independence of skilled attendance in the power department, were also factors in his decision to adopt electricity.

A LARGE ELECTRIC SIGN FOR MILWAUKEE.

One of the largest permanent electric signs in the West is being erected on the roof of the fourteen-story Majestic Building, Milwaukee, Wis., for a nearby department store. The sign will comprise two lines reading "Gimbel's—at the Bridge," 20-ft. letters being used in the name and 5-ft. letters in the words giving the location. The steel frame already completed measures 62 ft. high and 125 ft. long. Energy for the 1400 lamps in the display will be furnished by the Commonwealth Power Company, whose substation is located under the sidewalk near the building.

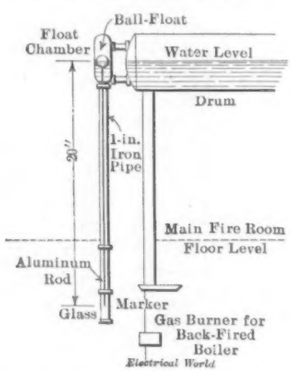
ORNAMENTAL STREET LIGHTING PROPOSED IN OKLAHOMA CITY.

If the proposal of the Chamber of Commerce of Oklahoma City is carried out, an ornamental street-lighting system will be installed in the district surrounded by the Santa Fé railroad tracks, Hudson Avenue, Reno Avenue and Second Street and also extending north on Broadway from Second Street to Broadway Circle. This plan calls for the erection of 591 posts and is said to have the approval of the city administration, which has agreed to bear 20 per cent of the cost of installation, maintenance and operation. The remainder is to be borne by the property owners, the whole matter being handled by the city treasurer's office on a taxation basis.

DISTANT-READING BOILER-LEVEL GAGE.

As pointed out in an illustrated article on page 1109 of the *Electrical World* of May 25, 1912, the new gas-burning 8000-kw central station of the Kansas Gas & Electric Company, Wichita, Kan., is so arranged that the pressure gages, valves and gas burners of the back-fired furnaces are brought down to the main turbine-floor level, where they can be manipulated by the engine-room attendants. Water-level gages as well are now installed in this lower firing aisle, so that the water level in the drums, 20 ft. above, can be inspected from below without going aloft to the front of the boilers to ascertain this information.

The novel long-distance level gage used comprises a float chamber connected to the upper drums, while suspended from this float chamber is a 1-in. pipe terminating in a gage glass. This entire system is filled with water at boiler pressure, and in the upper chamber floats a hollow copper ball carrying a slender aluminum rod 1/12 in. in diameter,



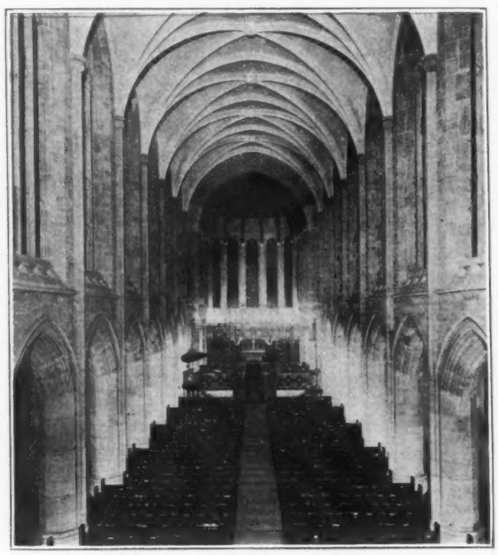
Distant-Reading Boiler-Level Gage.

which depends down through the 1-in. pipe, its lower end being visible in the glass chamber. This forms the marker which indicates the boiler-water level, the whole rod and float rising and falling with changes in the upper level. The devices have been in use several months, and in this time, according to Mr. C. B. Tingley, chief engineer for the Wichita company, have given thorough satisfaction.

Wiring and Illumination

CHURCH ILLUMINATION FROM CONCEALED LINEAR UNITS.

Tungsten linolite units concealed behind the vertical columns supporting the roof arches provide a novel form of indirect illumination for the Protestant Episcopal Cathedral of St. John at Denver, Col. Except for the lamps



Church Illuminated from Concealed Linear Units.

on the altar, the sole lighting of the auditorium is furnished by these 27-volt linear units, which, with their reflectors, are hidden in vertical recesses on the altar sides of the wall columns. The lamps are fed through conduit from the secondaries of low-voltage transformers mounted in the ceiling space above.

The building is 190 ft. long, with a 40-ft. nave and 7½-ft. side aisles. One hundred and twenty feet of linear lighting units have been employed, aggregating 1920 cp. Control of these units is effected from the altar. The effect of the installation is to give unusual diffusion in the main room as well as a high degree of illumination on the altar. An important incidental effect is the emphasis which the lighting puts on the architectural details of the church interior, the groins of the arches being particularly accentuated. The installation was made by Mr. J. Fischer, Denver.

SOME PRACTICAL SUGGESTIONS IN RELATION TO INDUSTRIAL LIGHTING.

Mr. Ward Harrison, of the National Electric Lamp Association, Cleveland, delivered a well-prepared address on "Industrial Lighting" before the Chicago Section of the Illuminating Engineering Society on Dec. 11. Mr. Harrison said that the value of proper factory lighting lies in the fact that it enables the workman to do his work quickly, accurately, cheerfully and safely during artificial-illumination hours. He advocated a considerable number of units. In spacing, the distance between lighting units should not be more than twice the vertical distance between the units and the working plane. Steadiness of light is important, and the speaker quoted from the Illuminating Engineering Society's "Primer of Illumination" to prove this. To secure steadiness of lighting in factories, he advises that motors and lamps be operated on separate circuits, although it is

difficult to induce factory owners to go to this expense. Care must be taken, if 25-cycle circuits are used, to select such lighting units that there will be no objectionable flicker. Any incandescent lamp taking less than 0.5 amp will usually flicker on 25 cycles.

Intensity of light may vary from 0.25 ft.-candle to 50 or more ft.-candles. However, these are extremes in both cases. The former figure is probably the lowest intensity to be considered in any aspect of industrial lighting, while the latter is given as the intensity over a very small area, where it is necessary to provide a very brilliant light at, say, a certain part of a machine. Probably 90 per cent of all industrial lighting installations will fall between 1 ft.-candle and 6 ft.-candles. In many installations 5 or 6 ft.-candles is not now considered too high, as the great point is to make the illumination serve to help the workman to do his work in the most efficient manner.

Glare has been defined as light out of place. Considering each individual working position, there should be no near-by sources of light having high intrinsic brilliancy. Further, there should be no light sources of any sort in the direct range of vision when the workman is looking at his work.

Mr. Harrison spoke of the need of uniformity of illumination and said that specular reflection should be avoided. It is worth while to provide the workroom with sufficient light to give it a bright, cheerful appearance. This will counteract the tendency of the men to slow down when it begins to grow dark.

The speaker advised his hearers not to lean too heavily on the convenient and easily used portable photometer in figuring the cost of lumens. He described tests which seem to show that ordinary high temperatures, such, for instance, as those caused by operating the lamp in an inclosing globe, have no unfavorable effect on tungsten lamps.

Curves were exhibited to show candle-power depreciation during the life of tungsten lamps. Considering the useful life of a lamp to end when it has fallen to 80 per cent of its initial efficiency, the average efficiency in horizontal candle-power was shown by tests to be 93.5 per cent. Old lamps take slightly less current than new ones, contrary to the general impression. Efficiency life curves show that when both the cost of energy and the cost of lamp renewals are taken into consideration it makes little difference whether tungsten lamps are burned to 75 per cent or 150 per cent of their rated life. The operation of tungsten lamps in series on multiple circuits, as is done to a considerable extent in outdoor work, should be discouraged. With the rapid advance in the design of tungsten lamps, changes in operating characteristics make series connection across multiple circuits inadvisable.

Reflectors received considerable attention in the closing portion of the address. Porcelain enameled reflectors were said to have a general efficiency of about 65 per cent. Tests conducted to exhibit the loss of efficiency due to the collection of dust showed that after forty weeks' use without being cleaned enameled-steel reflectors were 80 per cent efficient, prismatic glass about 68 per cent and translucent glass about 64 per cent. Mr. Harrison said that the use of all types of glass reflectors in industrial plants is decreasing. He thinks the enameled steel reflector somewhat preferable to the aluminum type for this class of work. Practically all new reflectors are one-piece units. Waterglass (slicate of soda) has been used successfully in coating brass lamp bases and sockets to protect them from acid fumes in factories. As to the color of reflecting surfaces in reflectors for incandescent lamps it was pointed out that bluish-tinted reflectors should be avoided owing to the characteristic spectrum of the lamp.

The discussion took the form of a lively debate over the merits of various types of reflectors, representatives of rival manufacturers showing unanimity in only one thing, and that was zeal in advocating the several designs of glass and metal reflectors which were championed.

ORNAMENTAL STANDARDS OF ST. LOUIS PUBLIC BUILDINGS.

Twenty-five five-lamp tungsten standards provide ornamental lighting for the Market Street side of the St. Louis City Hall Square, containing the municipal offices and municipal courts building. The posts are mounted on the

Fig. 1—Tungsten Post Lighting, St. Louis City Hall Square.

stone coping which separates the lawn from the sidewalk, and each carries four 40-watt lamps and one 60-watt lamp, contained in 12-in. and 16-in. balls respectively. The uprights measure 8 ft. and are supported by four scroll feet on the 3-ft. x 3-ft. stone blocks at a height of 22 in. above the sidewalk. A massive ring forms the mounting for the four lower arms, the main shaft extending through the center of this device for the support of the top lamp. Al-

Fig. 2—Ornamental Standards, St. Louis Public Library.

though the posts are of iron, they were coated first with copper bronzing, followed by an application of green paint, which effectively simulates the appearance of verdigris on bronze, lending much to the appearance of the standards. The posts were furnished by the Frank Adam Electric Company, St. Louis.

On the steps and approaches to the St. Louis Public

Library a rather extraordinary but handsome design of post is employed. The 7-ft. upright presents a succession of exfoliating leaves, rising from a square pediment which is borne by four tortoises. The main lighting unit is inclosed in a 12-in. ball around which is arranged a corona of eight 3-in. globes concealing 25-watt lamps.

WIRING INSPECTION AT BOSTON.

At a meeting of the New England Section of the National Electric Light Association held at Boston on Dec. 13 Mr. James E. Cole, head of the Wire Department of Boston, delivered an illustrated address upon electrical inspection. The history of central-station development was outlined, and the speaker touched upon the causes leading to the establishment of underground service by electric railway, lighting and other public utilities. After briefly recounting the legislation which led to the organization of the Boston Wire Department, Mr. Cole exhibited a great number of lantern slides of poor wiring construction in buildings prior to systematic inspection under the auspices of the municipality. For about twenty years this work has been carried on with admirable results, and the speaker gave special credit to the local central-station, telephone, telegraph and railway interests for their co-operation in cutting down the fire and accident hazards of both exterior and interior wiring. Probably 80 per cent of the reports to the department contending that specific fires are caused by electricity are found to be utterly mistaken.

The Wire Department deals not only with all classes of electrical conductors, whether they are installed in the open, inside buildings or underground, but also covers the installation inspection of all electrical devices and materials. The commissioner is made the sole judge of what constitutes proper insulation and safe installation. It is required by law that the commissioner be notified of all wiring to be installed within a building, with a penalty of from $10 to $50 for failure to notify. The department also makes special analyses of all fires supposed to have been caused by electricity.

An important part of the address dealt with actual causes of electrical fires as determined by the department. Many of these causes are apparently trifling, as in the failure to shut off the heater switches in a large mansion which was equipped with electric plate warmers in the butler's pantry, the warmers having been installed without notifying the Wire Department. The equipment was placed on the flooring of the cupboard with only thin asbestos paper between the heaters and the floor boards, the heaters being covered by a Russia iron cabinet and the whole inclosed in a wooden closet. The afternoon before the fire carpenters and plumbers were at work in the house preparatory to opening it for the winter. Through an oversight the heaters were left in circuit for hours, the floor boards became ignited, and the fire spread to the rest of the building, causing a loss of over $180,000.

In another case, a theater fire was caused by a plush drop curtain's coming into contact at the fringe with the border lamps, but the prompt action of the staff prevented its spreading. A fire which is of special significance in its relation to the holiday season and its hazards occurred in a store where a lamp cord became frayed and swung against a brass rod, which was in contact with a cash carrier system suspended by a hook the point of which was in contact with a gas pipe. Electricity passed through the carrier system to ground; the brass rod contact arced over, igniting ribbons carried by the rod, and hot metal and sparks were thrown into waste paper beneath. The fire was quickly put out, but there was danger of a serious blaze. In another establishment a crudely designed electric sign was left with the current on after the store closed for the night, and as the lamps were installed in thin wooden partitions the device overheated and was soon ruined. It had not been inspected because the owner had failed to notify either the Underwriters or the Wire Department. Other causes of fires were touched upon, including a high tide which submerged series arc-lighting wires carried under the structure without proper protection; leaving a lighted incandescent lamp in contact with a wooden partition in a department store during reconstruction of the display space, and pushing fixture wire joints in behind the insulating joint between a combination bracket and a gas pipe.

Letters to the Editors

DERIVATION OF FORMULA.

To the Editors of the Electrical World:

Sirs:—In the issue of the *Electrical World* for Nov. 9, page 994, Mr. Louis Cohen gave a derivation for an approximate formula for the inductance of aerial split conductors. I should like to call attention to a previously published derivation which is equally short and more accurate, in that the mutual inductance of wires is not assumed to be unchanged by dividing the conductors. This method, which consists of superposing systems in equilibrium, will be found in Professor Karapetoff's "Magnetic Circuit," Chapter XI, Problem 21. The method is applied to a line split in two parts, but it can easily be applied for any arrangement of split conductors.

Using Mr. Cohen's notation and denoting in addition the diagonal distance between conductors by D', Professor Karapetoff's formula becomes:

$$L = l\left(\log_e \frac{D}{a} + \log_e \frac{D'}{d} + 0.597\right) \text{ cm},$$

while Mr. Cohen's formula is,

$$L = l\left(\log_e \frac{D}{a} + \log_e \frac{D}{d} + 0.597\right) \text{ cm}.$$

On account of its greater simplicity and accuracy, the method of superposition would seem to be preferable.

Ithaca, N. Y. John F. H. Douglas.

CAUSE OF CONDENSATION.

To the Editors of the Electrical World:

Sirs:—In your issue of Nov. 16 is an article by Mr. F. G. Waldenfels on "Conduit Versus Open Work in Places Subject to Moisture, Corrosive Fumes, Steam, Etc." In the second column, on page 1050, he discusses the cause of condensation in a pipe that ran over some boilers to distributing cabinets. In explaining the condensation he says: "Cold air entered at the service pipe and traveled down through the service cabinet, then continued until it encountered the hot air in the conduit above the boilers. The temperature in the basement was very high and on the first floor it was very low, and the consequence was that condensation took place when the hot and cold air met." It may seem a little like splitting hairs to question that explanation, which in no manner affects the fact that condensation was responsible for the trouble, but it seems to me that from purely a physical viewpoint his explanation is a little erroneous. If, in Fig. 41, the cabinet in the boiler room were hermetically sealed, it is doubtful if any condensation would occur. It seems that the cause of condensation was moisture-laden air at 110 deg. Fahr. entering the cabinet within the boiler room. This air on passing through the pipe entered the cold room above and consequently the moisture was condensed. It does not seem quite reasonable that the condensation was due to cold air passing from above, because its humidity would decrease as the air became heated in the pipe over the boiler.

Madison, Wis. C. M. Jansky.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Single-Phase Commutator Motors.—M. LATOUR.—The author reviews the different types of single-phase commutator motors which have been tried in the single-phase traction experiments of the French railroad company "du Midi." The characteristic features of the different motor types are reviewed with special reference to former publications and patents of the author. The author has formerly shown that in the simple repulsion motor the currents produced in the short-circuit winding by the rotation generate a cross-field which in combination with the main field yields a rotary field at synchronism and assures good commutation at this speed. This fundamental property has decided the future of the repulsion motor. The author's compensated repulsion motor has the essential properties of the simple repulsion motor, besides being able to operate with unity power-factor. In series motors an artificial cross-field may be produced according to a German patent of the Oerlikon company and an Austrian patent issued to the author in April, 1904. Under the name of elliptic-field motor the author has described a motor which has since become known as a doubly-fed series motor and has been developed by Richter, Alexanderson and Osnos. The author then deals with the importance of the "friction area"; that is, the area of contact of the brushes with the commutator. To reduce the friction area is a very important point of the design of all single-phase commutator motors. This leads to the result that high peripheral speeds of the commutator are advantageous. The design of high-speed motors then leads to the use of a gear transmission. This is a characteristic feature of the locomotives of Jeumont, of the Westinghouse Company and of the Oerlikon Company, which seem to be perfectly satisfactory in mechanical respects. In principle the use of high speeds is possible with repulsion as well as series motors. But with repulsion motors, in which the number of poles is determined by the speed, the frequency of 15 cycles per second leads to a design with a small number of poles. This results in certain difficulties which can be overcome by various devices of the author (several short-circuits, etc.). Therefore, it is possible to build the repulsion motor for the speed conditions of the series motor. But for a given current

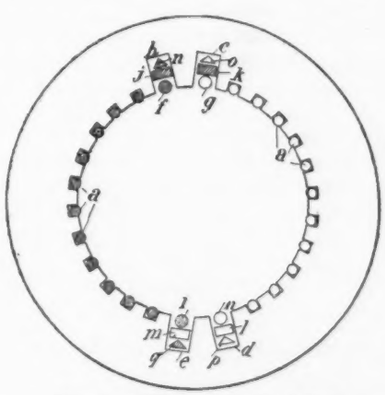


Fig. 1—Stator of Series Motor.

intensity the same voltage between commutator segments is the more dangerous at starting the smaller the number of poles. However, the repulsion motor is inferior at a frequency of 15 with respect to both weight and efficiency. The repulsion motor requires more iron and more copper. The author discusses the conditions of commutation at varying speed. He shows that by a certain arrangement of the excitation winding it is possible to produce a cross-field which is proportional to the current and independent of the speed. In order to reduce the losses of a motor it is advantageous to use a low frequency, narrow auxiliary poles, a small air-gap, high speed, and high number of poles. For a frequency of 15 cycles per second it is possible to reduce the losses so that they are insignificant. To simplify the

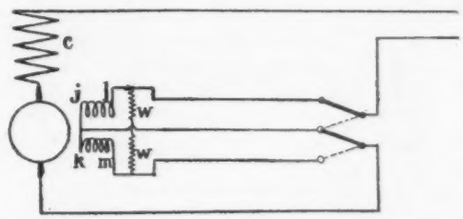


Fig. 2—Diagram with Excitation Coils in Parallel.

design of the series motor with auxiliary flux, the author has devised the arrangement of Fig. 1, which represents the stator of a series motor. The circles *a* represent the cross-section of the compensation winding placed in slots all around the periphery of the stator. In the slots *b c d e* this winding is represented by *f g h i*. The slots *b c d e* also contain the excitation winding which is to produce the field of the motor. The cross-sections of this winding are represented by the rectangles *j k l m*. The slots *b c d e* contain finally the third auxiliary winding (represented by the triangles *n o p q*), which produces a field displaced by 90 deg. with respect to the field of the motor. Those cross-sections which carry at any moment the current in the same direction (for instance, from the back of the paper to the front) are cross-hatched. At any moment the total current in slot *b* equals the total current in slot *d* but has the opposite sign. The same is true for *c* and *e*. There is, however, a non-symmetry between the slots *b* and *d* on one side and *c* and *e* on the other side with respect to the total current. When the conductors *j* and *l* on one side and *k* and *m* on the other side are connected together it is possible to form two coils for the excitation winding, which have the general appearance of the coils of a compensation winding as they are usually made to comprise the interval π between two poles. These excitation coils *j l* and *m k* may be connected in series or in parallel. If they are connected in parallel a resistance *w* may be employed, as shown in Fig. 2, so as to produce a phase difference between the two currents, assuring perfect commutation without any additional winding. The motor may be built as easily as the pure series motor and has the correct commutation field.—*Elek. Zeit.*, Nov. 28, 1912. Practically the same article, but slightly enlarged in a few details, in *Elek. u. Masch.* (Vienna), Dec. 1, 1912.

Alternating-Current Commutator Motors.—MARIUS LATOUR.—An article which the author submitted in January, 1901, to *L'Eclairage Electrique*, but which was not published. It is now published with an introductory note concerning the original date by the then editor of that paper, C. F. Gilbert. Latour's article deals with the use of auxiliary poles in a series motor and their excitation by current of suitable phase displacement.—*La Lumière Elec.*, Nov. 16, 1912.

Lamps and Lighting.

Lighting Generators for Automobiles.—C. J. WEBB.—The first part of an illustrated description of the electrical exhibits at the recent Olympia Motor Car Exhibition in London. The author gives a review of the features of

various lighting generators for automobiles. The first is the Leitner generator (Fig. 3). The chief feature of this machine lies in the fact that it is self-regulating, no mechanical or electro-mechanical devices being employed. The field magnets are shunt-wound, the shunt winding being connected up to subsidiary brushes *DD'* working on the same commutator as the main brushes *CC'* but arranged at right angles thereto. When the speed of rotation is low these brushes collect current and increase the excitation of the fields, but as the speed of the armature increases the magnetic field flux is distorted in the direction of rotation, the result being that the voltage of the subsidiary brushes is first reduced to zero, and then actually becomes reversed in sign, this negative current weakening the magnetic field to a greater and greater extent according as the tendency for the output to rise becomes greater. The generator is, therefore, automatic in action at all speeds. Other lighting generators described are the P. & R. and the Lucas. In the latter a mechanical device consisting of a slip clutch is provided to insure constant output with varying speed. The belt pulley through which the armature is driven is furnished with a small friction clutch in which the frictional surfaces are engaged and disengaged by an automatic centrifugal governor, the whole being self-contained in a dust-proof and oil-proof casing. The result is that, however fast the pulley may be revolving, the armature shaft to which it is indirectly coupled cannot exceed a certain predetermined speed. When the armature attains its maximum speed the friction clutch is automatically disengaged by the governor and the driving effort momentarily ceases. Whenever the speed drops the clutch again takes up the drive. The chief feature of the Brolt generator is the addition to the two main poles, which are excited by a shunt-wound coil connected to the brushes, of two auxiliary poles at right angles thereto (Fig. 4); the latter are unwound but are excited by the cross-magnetization caused by the working current in the armature. Two brushes are placed in the neutral position relative to the main poles, they being made wide enough to short-circuit several armature coils during the period of commutation. The action of the machine is as follows: When the armature is revolved a voltage is induced between the brushes exactly as in any ordinary generator and the machine commences to charge the battery as soon as the necessary speed is reached. The load current in the armature exercises a cross-magnetizing tendency which creates a magnetic flux in the auxiliary unwound poles provided to receive it. The armature coils short-circuited by the brushes cut this cross-flux, and in consequence there is produced in them a short-circuit current which is proportionate to the cross-flux and to the speed of rotation. Any increase of speed is immediately accompanied by a proportionate increase in the short-circuit current, which demagnetizes the main field and keeps the output constant. Again, if the output current should tend to increase, an increased cross-magnetization results, which, in turn, increases the short-circuit current, thereby preventing any increase in voltage. The automatic regulation of output is, therefore, obtained by purely electrical means, there being no moving parts whatever except the armature.—London *Elec. Review,* Nov. 22, 1912.

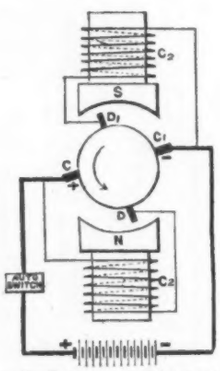


Fig. 3—Diagram of Variable-Speed Dynamo.

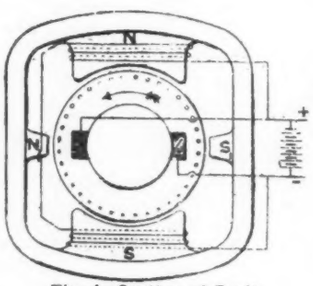


Fig. 4—Section of Brolt Dynamo.

Spectral Luminosity Curve of the Average Eye.—H. E. Ives.—The paper in full, an abstract of which has already been given in the *Digest.* It concludes his long series of articles on the photometry of lights of different colors.—*Philos. Mag.,* December, 1912.

Chemistry and Electric Lighting.—O. Kruh.—An English translation of his recent German article on the importance of chemical research on electric lighting invention.—London *Electrician,* Nov. 29, 1912.

Generation, Transmission and Distribution.

Grounded Versus Unearthed Neutrals on Alternating-Current Systems.—J. S. Peck.—A paper read before the British Institution of Electrical Engineers. The only two real advantages of grounding are (a) the limiting of the voltage between line wires and earth and (b) the possibility of cutting off any wire or feeder in the event of a "ground" upon it. The chief objection to grounding is the fact that the system cannot be operated with a ground on any line wire. The author discusses the question of grounding the neutral from the point of view of generating plant, high-voltage transmission circuits and low-voltage distribution circuits. Three classes of generator service are considered. First, in the case of a generator supplying energy to a network of underground cables, it is becoming general practice to ground the generator neutrals. It seems advisable to try connecting the generator neutrals solidly together, especially in the case of turbo-generators, where there is no angular variation in speed and therefore less chance of circulating currents. Should satisfactory operation be impossible, then only one generator should be connected to the neutral busbar, or resistance may be inserted between each generator and the neutral busbar. Of the three methods, that of connecting the neutrals solidly together is undoubtedly the simplest and best, while the method of operating with a ground on only one generator comes next in simplicity. The second class of service is that of generators supplying energy to overhead transmission circuits without transformers. With this arrangement in the majority of cases the weight of the argument is in favor of operating with the generator neutrals ungrounded. The third class of service is that of generators supplying energy to overhead transmission line through step-up transformers. In this case it is extremely desirable to ground the neutral or else to ground the low-tension side of the transformers. It is preferable to ground the neutral point of the generator through a rather low resistance. If it is not desired to connect permanently to ground, then a spark gap should be used in the ground connection. The author concludes that in the great majority of cases continuity of service will demand that the system be operated with an ungrounded neutral, and that in general the transformers should be connected in delta on both the high-tension and the low-tension windings.—London *Electrician,* Nov. 29, 1912.

Traction.

Direct-Current Versus Single-Phase Traction.—An editorial referring again to the recommendation recently made by Merz and McLellan on the use of continuous current with an overhead line at 1500 volts for the extensive Melbourne tramway system after a thorough comparison of single-phase and direct-current traction. The present writer seems to think that the comparison has not been perfectly fair in every respect. For single phase the frequency of 25 cycles was adopted in consideration of the motor load, but a frequency of 15 cycles would have caused considerable saving. For the cost of altering ordinary telegraph and telephone wires nine times as much money

was allowed for the single-phase in comparison with the direct-current system. With direct current at a pressure of 1500 volts the currents to be collected are so large in comparison with those in the single-phase system at a pressure of 10,000 volts or 15,000 volts that very destructive arcing is likely to result and thus raise the cost of maintenance very materially. "The claims of the high-tension continuous-current system will require very ample demonstration before the single-phase system can be disregarded." —London *Electrician,* Nov. 29, 1912.

Electric Traction in Italy.—G. CALZOLARI.—An illustrated article on electric traction on the old Giovi line between Genoa and Milan and between Genoa and Turin. The three-phase system with 3000 volts and 15 cycles is used with electric locomotives. Energy is supplied from a steam station containing two 5000-kw turbo-generators. Since the three-phase motors of the locomotives when running at a speed above synchronism are changed into generators and return energy into the line, a water resistor is provided in the power plant for the dissipation of the excess of energy which is not required at that time by a train. The arrangement of the water resistor with its automatic switch connections is described in great detail.—*Elek. Zeit.,* Nov. 28, 1912.

Paris.—A note on the reorganization of the tramways of Paris, France. Up to the present the system of the Compagnie des Omnibus in Paris has been operated in a number of different ways, including steam, compressed air and secondary batteries. It has now been decided to convert the whole system to electric traction, direct current being used in conjunction with an overhead wire in the outlying districts and with a conduit in the more central areas. It is thus hoped to provide a better, more organized and speedier service than has been possible up to the present. The system will be supplied with energy from the stations at St. Denis and Vitry, three-phase current at a pressure of 12,500 volts and a frequency of 25 cycles being used. This will be transformed by rotary converters to direct current at 600 volts in six substations. There will be thirty car depots. Two types of car have been decided upon, one a bogie type, containing fifty-five seats, and the other having a long wheelbase and forty-five seats, this type being particularly intended for lines where the gradients are steep and traffic heavy.—London *Electrician,* Nov. 22, 1912.

Wires, Wiring and Conduits.

Protective Covering of Rubber Cables.—F. FERNIE.—The author questions whether the ordinary impregnated braiding of rubber cable does not do more harm than good. As soon as the waterproof qualities that a braiding may have are destroyed it becomes a positive danger to the cable rather than a help, for it serves as a sponge to hold moisture in close contact with the rubber and by capillary conductance helps to maintain the supply of moisture. It thus serves as a moist "earth" in contact with the rubber. Wires which are simply taped largely avoid this disadvantage, and, further, a well-impregnated tape can be made more waterproof than braiding. The author has immersed rubber cable in various solutions for a long period without being able to detect any deterioration in the rubber, as shown by its stretching qualities. On the other hand, if the same cable be immersed and an electrical pressure be maintained between the conductor and the liquid, the rubber will in some cases deteriorate, generally in spots rather than along its whole length. The same thing may often be noticed where "neutral" cables are placed alongside "live" conductors, the latter being faulty and the former apparently uninjured, although the braiding may be dripping wet. From this it would appear that electrical pressure and moisture combined cause the failure of the rubber. If this be the case, the difficulty could be got over by grading the insulating covering of the cable so that the whole or nearly the whole fall of potential between the conductor and ground should take place across an inner insulating wrapping, and that this should be protected by an outer wrapping impervious to water but yet having a very low electrical resistance. This outer layer would thus be in the same position as the rubber in a neutral cable and would not tend to fail. Of course, this object is completely obtained by putting a lead or other metal sheath over the rubber. Apart from metal sheathings, the nearest approach to this condition is the cab-tire sheathed cable.—London *Electrician,* Nov. 29, 1912.

Installations, Systems and Appliances.

Cost of Electricity in Various Central Stations.—FRIEDRICH ROSS.—The author refers to a recent article by Hase, who claimed that municipal gas plants give better financial results to a city than municipal electric central stations. The present author comes to different results on the basis of statistical data which are given in several tables. He finds that the figures for interest and amortization of the capital investment are about the same in both cases. The author concludes that it is more economical for a city to urge the use of electricity for interior lighting and for motors than to advocate the use of gas. The following data are abstracted from a table in the article. They relate to thirty-eight typical European central stations. Those marked with an asterisk are transmission systems delivering energy over extended areas:

	Kw-hr. Sold, in Millions per Year.	Cost of Operation per Kw-hr., in Cents.	7.5 Per Cent Interest and Amortization on Investment per Kw-hr., in Cents.	Gross Yearly Receipts, in Per Cent of Investment.	Average Receipts per Kw-hr., in Cents.	Cost of Coal per Kw-hr., in Cents.
Vienna	97	2.1	1.9	15.4	5.75	0.7725
Upper Silesia*	87	0.5	0.65	12.4	5.75	0.3675
Essen	76	0.925	0.75	13.0	2.075	.....
Hamburg	38	3.54	3.2	8.1	6.45	0.685
Cologne	32	1.225	1.175	12.7	2.95	0.54
Frankfort-on-Main	31	1.45	1.375	19.7	4.05	.....
Dortmund*	24	0.675	0.9	6.3	1.375	0.51
Reisholz*	27	0.975	1.675	7.3	2.425	.....
Schöneberg	22	1.975	1.55	13.4	4.4	0.625
Dresden	22	1.85	1.75	14.5	4.825	.....
Hagen (Mark)*	21	0.825	1.0	8.7	1.8	0.5425
Amsterdam	19	1.325	1.425	12.3	4.6	0.5875
Dortmund	19	1.3	1.875	10.4	3.6	.....
Düsseldorf	16	1.275	1.875	14.6	4.375	0.825
Strasburg	17	2.775	2.9	7.0	4.975	0.705
Charlottenburg	16	1.25	1.8	17.6	4.8	0.58
Chemnitz	14	1.35	1.325	15.2	3.75	0.8075
Elberfeld	13	1.325	2.025	9.3	3.325	0.585
Breslau	13	1.375	2.075	16.1	5.3	0.5425
Magdeburg	12	1.4	1.4	20.8	4.775	0.98
Barmen	11	1.3	1.8	11.4	3.65	0.5825
Bremen	11	2.475	1.9	16.1	6.1	0.7225
Siegen*	10	1.2	0.825	8.5	2.125	.....
Mannheim	10	1.375	1.8	14.4	4.325	1.0275
Duisberg	9	1.2	1.2	11.2	2.675	0.9225
The Hague	8	1.325	1.4	19.2	4.5	1.1125
Rheydt	8	1.275	1.675	8.6	2.65	0.90
Wiesbaden	7	2.2	2.025	16.9	6.25	0.905
Leipzig	6	2.025	2.5	19.3	7.8	0.6775
Crefeld	6	1.65	1.175	19.0	4.225	.....
Altona	5	3.4	2.25	14.9	7.0	0.79
Erfurt	5	2.425	2.15	13.3	5.7	0.8475
Potsdam	5	1.35	1.125	24.7	4.425	0.5525
Neuss	3	1.05	1.55	7.8	2.075	0.865
Agram	3	1.475	0.95	13.1	3.15	0.85
Deuben	3	1.9	1.75	11.7	3.925	0.775
Nymwegen	2	1.45	1.625	9.0	3.1	0.8925
Pressburg*	1	1.925	2.6	22.6	8.45	0.4675

The table in the article also gives figures on the load-factor, the age of each plant and other matters.—*Elek. Zeit.,* Nov. 28, 1912.

Municipal Ownership.—FASOLT.—The author thinks that the lack of success of municipally owned or operated stations is due less to municipal ownership than to the fact that the municipalities do not want to pay sufficiently high salaries to attract the best men for the management. Figures from German practice are given.—*Elek. Zeit.,* Nov. 28, 1912.

Electrophysics and Magnetism.

Effect of Magnetic Fields on Resistance.—C. W. Heaps.—An account of a series of experiments the chief results of which are as follows: For paramagnetic and diamagnetic metals a transverse field produces a greater increase of resistance than does a longitudinal field, and for small magnetizing forces the increase is proportional to the square of the field strength. Crystals of lead sulphide in a magnetic field behave like an isotropic paramagnetic or diamagnetic metal. The resistance of iron pyrites is unaltered by a magnetic field; at least, if there is a change it is smaller than 2×10^{-5} per ohm for a field of 10,000. Whatever the direction of the magnetizing force, the resistance of molybdenite decreases, and it decreases much in the same way as does the resistance of Heusler alloy in a longitudinal field. The behavior of magnetite in a magnetic field indicates that this mineral has a very complex internal structure. It has different properties along different axes even when subjected to magnetizing forces much greater than are necessary to produce saturation. For fields greater than 4000 or 5000, after the magnetization has reached a maximum, the dR/R (the change of resistance divided by the resistance in zero field) and the field strength H are always connected in a linear relation. Indeed, this seems to be the case for everything examined, provided a large enough field is had.—*Philos. Mag.*, December, 1912.

Electrochemistry and Batteries.

Electrolytic Tanning.—A note on the installation of a demonstration plant of the Groth system of electrolytic tanning. A pure and strong tanning of heavy hides is produced in six weeks or less as compared with an even number of months by an ordinary process, while the quality of the leather produced is good. The electrolytic plant is entirely automatic.—London *Electrician*, Nov. 29, 1912.

Units, Measurements and Instruments.

Measuring the Thomson Effect.—H. R. Nettleton.—An abstract of a (British) Physical Society paper giving an investigation of the distribution of temperature down a conductor conveying an electric current and at the same time moving uniformly through two fixed temperature sources. The effect of the Thomson heat on the distribution is seen to be exactly similar to the effect of a small impressed velocity. This result is applied to mercury to measure the Thomson effect by comparing the alteration of temperature dT_1 at a point near the middle of the gradient caused by reversing a current of I amperes with the alteration of temperature dT_2 at the same point due to a flow of mercury of m grammes per second. It is shown that without any approximation as to emissivity loss or magnitude of Joulean heat $2IS/ms = dT_1/dT_2$, where s is the specific heat of mercury and S the specific heat of electricity. Working with currents of from 4 to 9 amp and with flows of different magnitudes, but never exceeding 1 cm per hour, consistent values of S are obtained, the value at 61 deg. C. being 1.52×10^6 calories per degree Centigrade per coulomb. The thermo-junctions, which were of iron and constantan, were fused through the glass tubes with inappreciable distortion.—London *Electrician*, Nov. 22, 1912.

No-Load Loss of Watt-Hour Meters.—H. Bueggeln.—An article pointing out the serious energy losses due to the current passing continuously through the voltage coils of watt-hour meters in distribution systems with many customers who use current only for a short time. The matter is especially serious in distribution systems in agricultural districts. A good alternating-current meter consumes at 110 volts continuously at least 1 watt and at 220 volts 1.5 watts. The yearly consumption is therefore 8.76 kw-hr. at 110 volts and 13.14 kw-hr. at 220 volts.—*Elek. Zeit.*, Nov. 28, 1912.

Telegraphy, Telephony and Signals.

Loud-Speaking Telephone.—A note on a recent somewhat remarkable British patent (No. 17,028, Nov. 21, 1912) of A. Vojen. "A loud-speaking telephone receiver is made of iron or platinum and provided with a specially treated wire of copper or aluminum, which enables it to dissociate under the influence of a varying electric current. It is also provided with a double plate and two horns, the movements of which are independent. An ordinary transmitter is used at the other end of the line. It is said that the radioactive dissociation of the wire reacts chemically with the iron and sets free sufficient energy to actuate the membrane of the receiver, by bombardment, so as to give audible speech even if the person at the transmitter is 11 ft. distant from his instrument."—London *Elec. Eng'ing*, Nov. 28, 1912.

Submarine Telephone Cables.—J. G. Hill.—The first part of a mathematical article on the loading of submarine telephone cables giving a comparison between coil-loaded and continuously loaded cables with special reference to some actual cables of both types between England and Belgium.—London *Elec. Review*, Nov. 29, 1912.

Miscellaneous.

Electric Welding.—V. D. Green.—A continuation of his illustrated paper giving notes on electric welding. After discussing the welding of copper he gives details of welding machines, especially of that of Elihu Thomson and of the automatic switch of the author.—London *Elec. Review*, Nov. 22, 1912.

Austria-Hungary.—An article giving statistical data of the electrical export trade of Austria-Hungary in the first half of 1912.—*Elek. Zeit.*, Nov. 21, 1912.

Laboratory.—W. Brown.—An article on the equipment of the electrical engineering laboratories of the Royal College of Science in Dublin, Ireland.—London *Electrician*, Nov. 29, 1912.

Book Reviews

Ratgeber für die Ökonomische Erzeugung und Verwertung Elektrischer Energie. By Adolf Prasch. Vienna: Druckerei und Verlags-Aktiengesellschaft. Part II, 316 pages, 14 illus. Price, 2.80 marks.

The second volume of a book on the economical production and use of electrical energy. It deals with a number of practical questions concerning the cost of installing electric light and motor service, especially in relation to plants which are situated in Austria. Although there are not a great many illustrations or diagrams to be found in the book, there are numerous tables of costs, dimensions, and other details for the guidance of consumers, purchasers or operators. In the appendices are some useful lists of rules as applied in Austria to electric plants and installations.

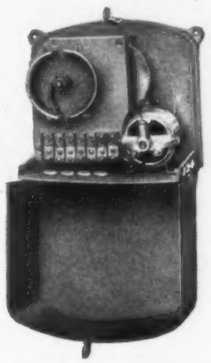
Practical Mathematics. Part I. Arithmetic with Applications. By Claude Irwin Palmer. New York: McGraw-Hill Book Company. 136 pages, 20 illus. Price, 75 cents. Part II. Geometry with Applications. 150 pages, 130 illus. Price, 75 cents.

A very practical pair of elementary little volumes on arithmetic and geometry as applied to the needs of the artisan and workman. From this standpoint the books have been prepared with much skill and judgment. Nearly all of the numerous examples and problems have been specially prepared from actual practice in shopwork, building and construction. In this way the books are well adapted as primers for home study by adults who may desire to brush up the arithmetic and geometry of their past school days. Mechanics seeking to become foremen or foremen seeking to equip themselves for contracting will be likely to find much help from these little volumes. It would be well if such books could be introduced into schools for the sake of the practical suggestiveness of the problems used.

New Apparatus and Appliances

A CABINET-TYPE FLASHER.

The Reynolds Electric Flasher Manufacturing Company, of Chicago, has developed for the market a motor-driven flasher which is entirely incased in a cast-iron cabinet. The illustration shows this flasher with the hinged cover hanging down to expose the interior arrangement. The apparatus consists of a motor built for continuous flasher duty, a train of gears, a revolving brush, four contacts and the necessary fuses and terminals. Its construction involves a new principle, as the only moving current-carrying member is a feeder brush. The contacts are stationary and there is little wear, while the simplicity of the apparatus renders it unlikely to get out of order. An unusually quick make-and-break is obtained, and loads up to 10 amp for each contact are handled with little arcing. The cabinet type of flasher may be used for from one to four circuits. In connecting it in service it is only necessary to attach mains to the various binding posts. The size of the cabinet is 10.5 in. by 9.5 in. by 5.5 in., which permits installation in confined spaces. The manufacturer claims that the device meets all of the Underwriters' rules and has the further advantage of low initial cost.



Interior of Electric Flasher.

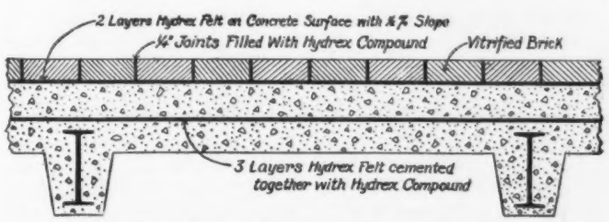
ACID- ROOFING THE FLOORS OF BATTERY ROOMS.

A great deal of attention is being given to the proper method of acid-proofing the floors of battery rooms. While it is recognized that nothing can be done to make concrete acid-proof in itself, floors of such material have been treated with linseed oil thinned down with gasoline; but this method retards the action of the acid only temporarily. Acid-proofing preparations have been tried by one of the leading concrete construction companies of New England, but have not proved a uniform success.

The general construction of the floor of a battery room consists of vitrified brick or tile placed on a concrete base. Leading authorities state that the best way to make such a floor acid-proof, is to place several layers of acid-resisting felt, cemented together with an acid-resisting compound, between the brick and the concrete. An approved method of doing this is to give the concrete floor first a coating of hot compound and then lay in this several thicknesses of felt, lapped so that the joints of one layer break joints with the under layer. Where this procedure is followed it is unnecessary to use sand for embedding the brick. To protect the walls and any columns in the battery room, it is advisable to turn up the felt for a foot or so at the walls or columns, putting three courses of brick against the felt and pouring the compound behind the brick so as to make a tight joint.

Two products known as Hydrex felt and Hydrex compound have recently been put on the market, and it is stated as the result of tests of the New York Edison Company that neither the felt nor the compound when used in the floors of battery rooms is at all affected by sulphuric-acid solutions. This company, which is noted for using large factors of safety in all of its construction, takes extra precautions in acid-proofing floors, usually specifying two distinct courses of several layers of acid-resisting felt, cemented together with acid compound.

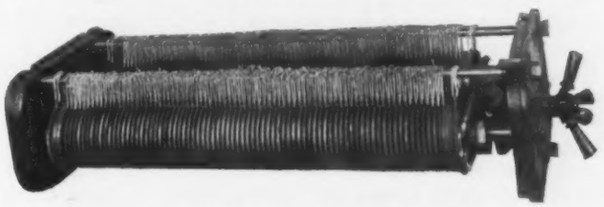
The accompanying illustration shows a section through a battery-room floor in which the above-mentioned products are used. Hydrex felt and compound are made by the Hydrex Felt & Engineering Company, 120 Liberty Street, New York.


2 Layers Hydrex Felt on Concrete Surface with ¼" Slope
¼" Joints Filled With Hydrex Compound
Vitrified Brick
3 Layers Hydrex Felt cemented together with Hydrex Compound

Cross-Section of Battery Room Floor.

COMPRESSION RESISTOR FOR CONTINUOUS-DUTY CONTROLLER.

For continuous-duty controllers or rheostats of the graphite compression type dissipating over 10,000 watts the use of many comparatively small inclosed compression units connected in series becomes unnecessarily expensive and complicated, although for some service this construction has advantages that make it worth while. To do away with this construction when it is not necessary, the Allen-Bradley Company, of Milwaukee, is using prepared graphite plates of two different sizes, one 6 in. in diameter and 0.25 in. thick and the other 4 in. in diameter and 0.1875 in. thick. These are suspended alternately, face to face, one 6-in. plate and then one 4-in. plate, by asbestos cords from a horizontal rod. This construction affords a large area over which to dissipate the heat and also has the advantages gained by the horizontal suspension described in the *Electrical World* of Nov. 16 last, page 1059. A resistor of this type has a dissipating capacity of about 2 kw per foot, and as a range of 1 to 200 can be obtained between the maximum and minimum resistance without perceptible steps in between, a very satisfactory rheostat is obtained.



Compression Resistor for Continuous-Duty Controller.

The accompanying cut shows (with casing removed) a continuous-duty resistance armature controller used in connection with an automatic starter for a 40-hp, 220-volt motor driving a fan. The speed of this fan can be set at

any value from rest up to the maximum speed and raised or lowered with absolute smoothness. There are two horizontal columns of resistor plates in this controller connected in series. The pressure is applied to both by means of a pilot-wheel, screw and equalizing mechanism shown at the right. The entire device is protected by a perforated metal drum.

PORCELAIN-CLAD REACTORS.

In central stations distributing alternating current protective reactors in connection with lightning arresters on overhead lines have been in successful use for a long time. In recent years prominent engineers have advocated and central stations have adopted protective reactors, connected to generators, transformers, busbars and feeders in generating stations. These reactors are placed at some or all the points where they are considered most necessary, as follows: (1) On the leads of generators or transformers feeding busbars; (2) on the busbars between different sections of buses, and (3) on the feeder circuits fed from the busbars.

The protective reactors so located fulfil the main function of limiting the amount of current that may flow from any part of the system into a short-circuit in apparatus or connections inside the station or close to the station. By so limiting the abnormal flow of current into a short circuit, the generating system as a whole is relieved from possible disastrous effects of short-circuits. Also, at the time of disturbance on the system, when the generating frequency and voltage are momentarily lowered, the reactors will reduce the energy output and thereby minimize the change in frequency which often throws out of step the synchronous apparatus at the substations and the generators of interconnected stations. The added reactance also makes the circuit more reliable for synchronous operation.

PRACTICAL APPLICATIONS.

In all central stations operating high-speed turbo-alternators the necessity of protective reactance on generators and sections of busbars has become apparent, and the larger central stations have led the way to the solution of this important problem by the extensive adoption of these devices. Their experience has demonstrated to be unfounded the fears of complications or disturbances caused by the reactors upon the operation of switches, underground cables, transmission lines, etc.

Protective reactors on the station end of cable feeders have been recommended and are now being introduced in this country. Their effect upon the operation of different systems is illustrated in the series of curves (Figs. 1, 2, 3 and 4), which show the energy output at the time of a short-circuit on a cable feeder, with or without protective reactances.

The curves indicate that the feeder protective reactors keep the output of energy into the short-circuit within safe operating limits, and this action is more effective the nearer the short-circuit is to the station. As the energy output of the station has the effect of slowing down the generators and thereby throwing out of step the synchronous apparatus on the system, it will be seen that protective reactors on feeders are nearly as important for the continuity of service as protective reactances on generators.

The commercial value placed upon the continuity of service must determine the outlay and the extent and degree of protection commercially warranted in any particular locality.

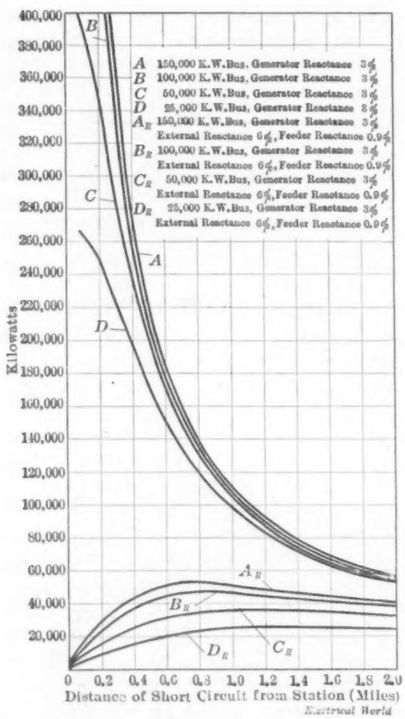

A 150,000 K.W. Bus, Generator Reactance 3%
B 100,000 K.W. Bus, Generator Reactance 3%
C 50,000 K.W. Bus, Generator Reactance 3%
D 25,000 K.W. Bus, Generator Reactance 3%
A_R 150,000 K.W. Bus, Generator Reactance 3%, External Reactance 6%, Feeder Reactance 0.9%
B_R 100,000 K.W. Bus, Generator Reactance 3%, External Reactance 6%, Feeder Reactance 0.9%
C_R 50,000 K.W. Bus, Generator Reactance 3%, External Reactance 6%, Feeder Reactance 0.9%
D_R 25,000 K.W. Bus, Generator Reactance 3%, External Reactance 6%, Feeder Reactance 0.9%
Kilowatts
Distance of Short Circuit from Station (Miles)
Electrical World

Fig. 1—Power Output in Short Circuit on Cable from 6600-Volt, 25-Cycle Bus.

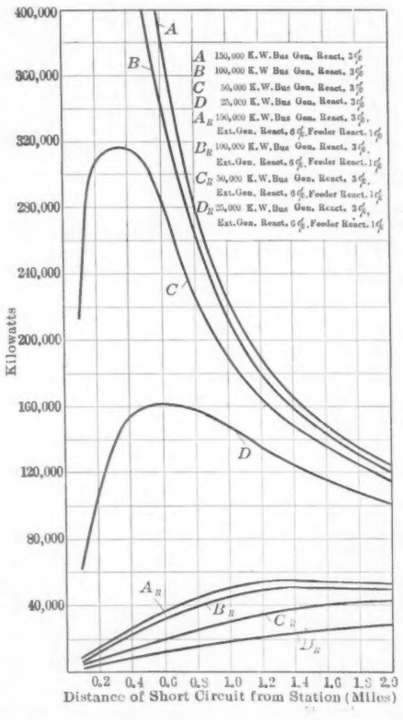

A 150,000 K.W. Bus Gen. React. 3%
B 100,000 K.W. Bus Gen. React. 3%
C 50,000 K.W. Bus Gen. React. 3%
D 25,000 K.W. Bus Gen. React. 3%
A_R 150,000 K.W. Bus Gen. React. 3%, Ext. Gen. React. 6%, Feeder React. 1%
B_R 100,000 K.W. Bus Gen. React. 3%, Ext. Gen. React. 6%, Feeder React. 1%
C_R 50,000 K.W. Bus Gen. React. 3%, Ext. Gen. React. 6%, Feeder React. 1%
D_R 25,000 K.W. Bus Gen. React. 3%, Ext. Gen. React. 6%, Feeder React. 1%
Kilowatts
Distance of Short Circuit from Station (Miles)

Fig. 2—Power Output in Short Circuit on Cable from 13,200-Volt, 25-Cycle Bus.

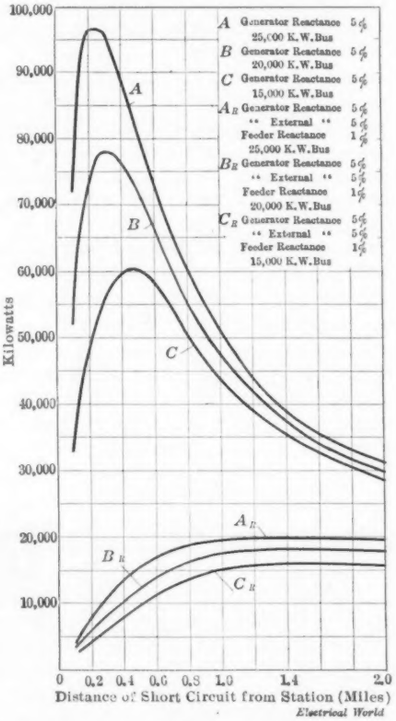

A Generator Reactance 5% 25,000 K.W. Bus
B Generator Reactance 5% 20,000 K.W. Bus
C Generator Reactance 5% 15,000 K.W. Bus
A_R Generator Reactance 5%, External 5%, Feeder Reactance 1% 25,000 K.W. Bus
B_R Generator Reactance 5%, External 5%, Feeder Reactance 1% 20,000 K.W. Bus
C_R Generator Reactance 5%, External 5%, Feeder Reactance 1% 15,000 K.W. Bus
Kilowatts
Distance of Short Circuit from Station (Miles)
Electrical World

Fig. 3—Power Output in Short Circuit on Cable from 6600-Volt, 25-Cycle Bus.

Protective reactors on the station end of cable feeders have been recommended and are now being introduced in this country. Their effect upon the operation of different systems is illustrated in the series of curves (Figs. 1, 2, 3 and 4), which show the energy output at the time of a short-circuit on a cable feeder, with or without protective reactances.

The curves indicate that the feeder protective reactors keep the output of energy into the short-circuit within safe operating limits, and this action is more effective the nearer the short-circuit is to the station. As the energy output of the station has the effect of slowing down the generators and thereby throwing out of step the synchronous apparatus on the system, it will be seen that protective reactors on feeders are nearly as important for the continuity of service as protective reactances on generators.

The commercial value placed upon the continuity of service must determine the outlay and the extent and degree of protection commercially warranted in any particular locality.

PORCELAIN-CLAD REACTORS.

The Metropolitan Engineering Company, of Brooklyn, N. Y., has developed a full line of these reactors to meet the requirements for the smallest and largest generators and circuits, ranging from 150-kw to 20,000-kw sizes. The company manufactures three classes of reactors as follows: Generator reactors for large turbo-generators and large transformers; busbar reactors for sections of busbars or tie buses between stations, and feeder reactors for distributing feeders or auxiliary apparatus at stations, and also for small turbo-generators in stations of small size.

GENERATOR REACTOR.

The construction of these coils is illustrated in the photographs. The coil consists of a series of horizontally wound spirals supported and insulated by porcelain arms having suitable recesses for the windings (Fig. 5). The arms are assembled radially as vertical walls between a center core of concrete or alberene stone (Fig. 6) and an outer inclosing wall built up of special porcelain segments (Fig. 7). These cellular compartments so formed allow natural ventilation for the coil. The whole is supported at the two ends by heavy concrete headers (Fig. 8) securely held by a number of brass bolts with insulating mica tubes passing through the heads and the wall of special porcelain segments from top to bottom. Ventilating holes are connected with each vertical cellular compartment of the coil.

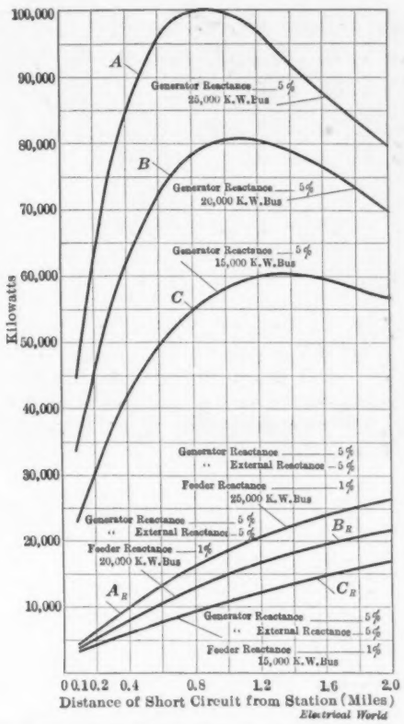


Fig. 4—Power Output in Short Circuit on Cable from 13,200-Volt, 25-Cycle Bus.

The winding consists of insulated and specially stranded cables, securely fastened at the ends to terminals passing through porcelain bushings cast into the concrete heads. Fig. 9 shows the sectional drawings of a large generator reactance. Fig. 10 shows three large coils in different stages of construction. The last coil to the left shows a layer of solid arms which are added to the top and bottom to increase the insulation between the winding and the header. Fig. 11 is a top view of a coil under construction, showing the way the winding is laid in the porcelain arms, and Fig. 14 is a photograph taken of a set of three 280-kva, 6600-volt, 25-cycle reactor coils in service. The coils are resting upon eight small concrete pillars and insulators which allow space for natural ventilation. The constants of each coil are as follows:

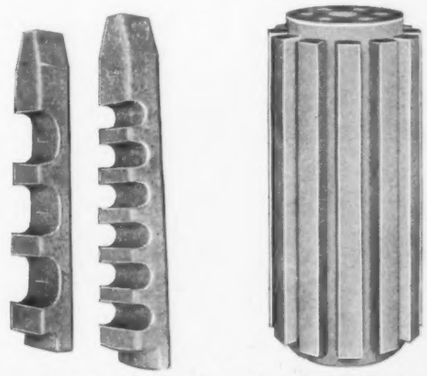


Fig. 5—Porcelain Arms for 20,000 and 7000-kw Turbo-Generator Protective Reactors.

Fig. 6—Center Core for Generator Protective Reactor.

Fig. 7—Porcelain Segment for Inclosing Wall of Generator Protective Reactor.

Fig. 8—Concrete Header and Terminal Bushing of Generator Protective Reactors.

Number of turns	34
Reactance in ohms	0.0914
Reactance in percentage	4.2
Equivalent resistance	0.00204
Ohmic resistance	0.00195
Calculated alternating-current resistance	0.00198
Current, amps	1750.
I^2R losses, kw	6.05
Foucault losses, kw	0.186
Total losses, kw	6.236
Temperature rise full load for three hours, deg. C	33.

The heating is very small and considerably less than the heating allowed for the generators. Each coil is tested at five times the working potential.

The main standard parts are adaptable to a practically unlimited range of sizes of reactors. In fact, by merely changing the number and shape of slots in the radial arms all parts can be used in the construction of coils having single or double conductor windings, a different number of turns in each layer and a smaller or greater number of layers. By so varying the constants, the builder can meet all conditions of size of generators, sections of busbars and voltages and frequencies of systems.

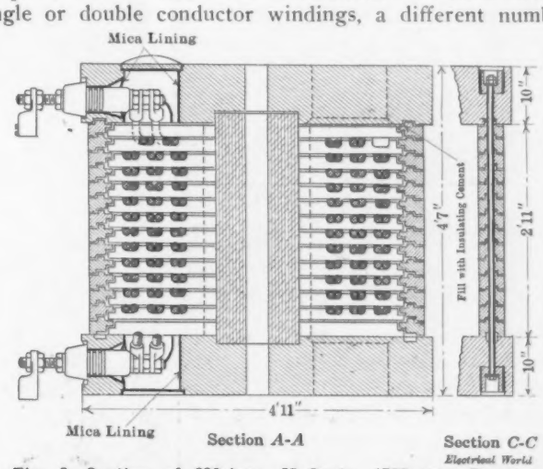


Fig. 9—Section of 280-kva, 25-Cycle, 1750-amp Reactor.

BUSBAR REACTORS.

These are made of the same design and construction as the generator reactors by proper change of the number

and shape of slots in the radial arms and varying the number of layers in each coil so as to obtain the desired amount of reactance. It will be seen, however, that with a very slight increase in the height of the coil the value of reactance can be greatly increased. For instance, the 280-kva, 25-cycle reactor of Fig. 9 is 59 in. in diameter and 55 in. high, while a 504-kva reactor would be 59 in. in diameter and 67½ in. high, the height of copper in each case being 30 in. and 42½ in. respectively.

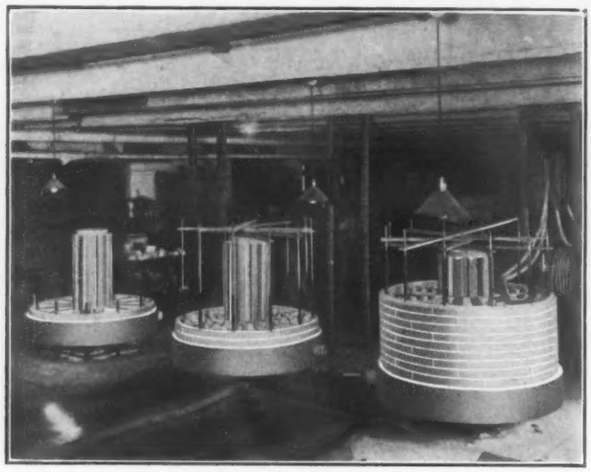


Fig. 10—Generator Protective Reactors Under Construction.

FEEDER REACTORS.

In this case the amount of current to be handled is necessarily smaller than in the types of reactors previously mentioned. The coils therefore are of considerably smaller dimensions both in floor space and in height. The general outer construction (Fig. 12) is the same as in the larger coils, but the pancake windings (Fig. 15) are made of insulated copper bands spirally wound. The cotton braid insulation is thoroughly saturated with "petrite" and the coil is firmly taped and saturated with "petrite" and baked. These coils are placed on the porcelain arms and the successive coils are connected in series. The terminals are brought out at the heads through porcelain insulators (Fig. 13). The coils are thoroughly inclosed and self-cooled up to carrying capacities of several thousand kilowatts.

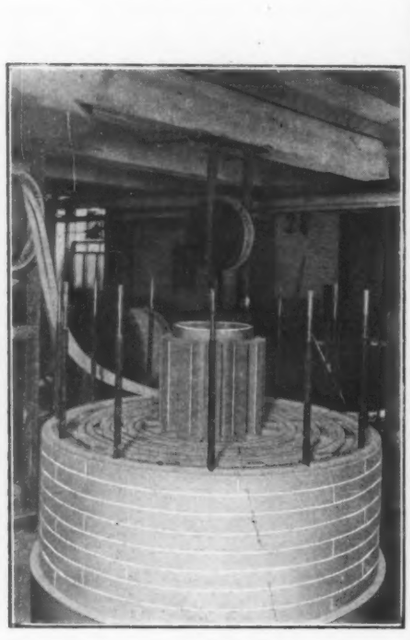


Fig. 11—Multiple Winding for Large Reactor.

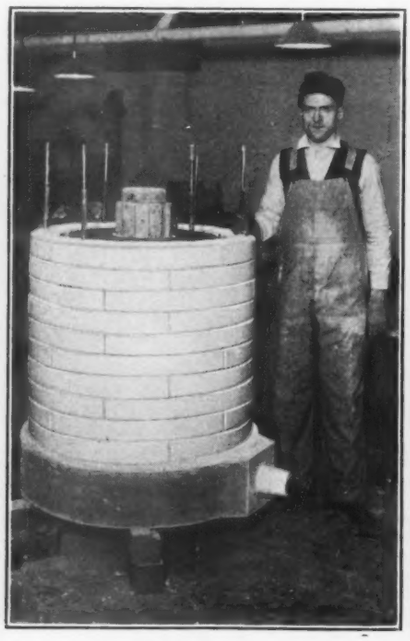


Fig. 12—22-kva, 25-Cycle Feeder Protective Reactor.

CHARACTERISTICS OF PORCELAIN-CLAD REACTORS.

These developments were the outcome of several years' investigation, experimenting and careful design, supplemented by practical tests under the most severe operating conditions of central stations. The coils are porcelain-clad and the windings are imbedded at their supports in walls of smooth porcelain insulators. This fireproof and insulating material was selected for its good electrical and mechanical qualities, which are entirely unaffected even by high temperatures. The smooth glazed surfaces of the porcelain also facilitate the inspection and cleaning of the coils. While the selection of material gives a large factor of electrical safety, the almost monolithic construction insures mechanical safety.

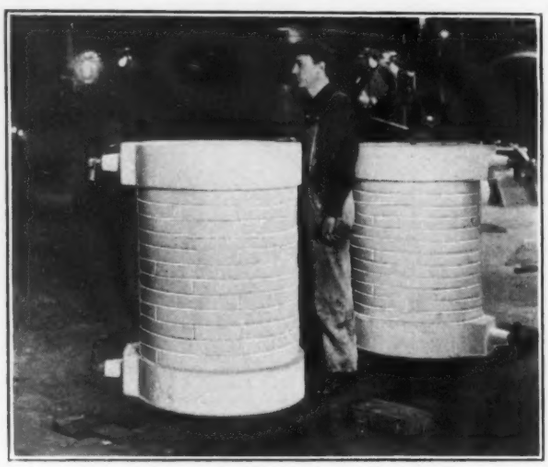


Fig. 13—Feeder Protective Reactors.

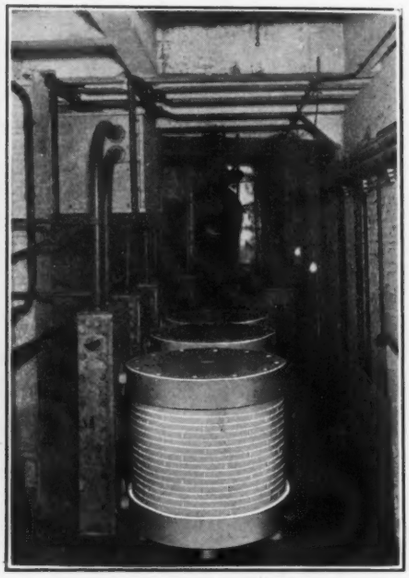


Fig. 14—Three 280-kva, 25-Cycle Reactors in Service.

The selection of the type of winding, pancake windings in series in place of a drum winding, gives a shorter and more "squatty" coil, a condition essential to reduce flux leakage and therefore obtain the greatest reactance per turn. This series arrangement of pancake windings also produces the minimum potential gradient between any two

points of the coil; hence it gives the largest electrical factor of safety. This feature is of greatest importance in extra high-potential reactors, as with the increase in number of turns and the number of layers of pancake coils the total difference of potential is gradually distributed from the top to the bottom layer with good insulation between

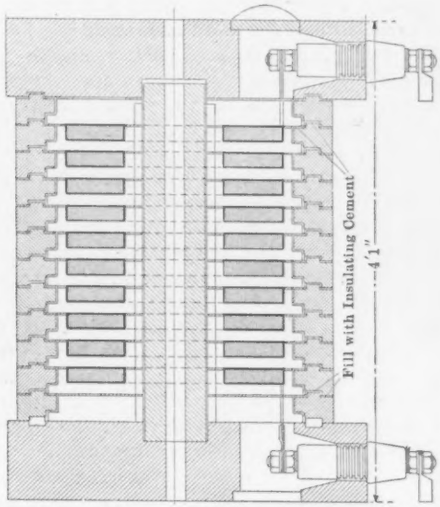


Fig. 15—Section of 22-kva, 25-Cycle Feeder Protective Reactor.

each layer, as in a transformer with different coils in series.

The special stranding used to reduce the Foucault losses in reactors of large amperage was the result of a minute analysis of the sources of these losses, which were effectually overcome by a simple process of making the cable. Elimination of Foucalt losses also made it possible to have the windings insulated throughout with a special insulation which protects the windings against moisture and foreign objects accidentally falling or being magnetically drawn into the coil.

The reactors are compact, self-supporting and porcelain-clad. They are, therefore, easily installed and do not require bracings between sets of coils to hold them firmly in place. The conductors are insulated throughout to prevent short-circuits from foreign objects falling or being thrown into the coil. Each coil is tested to ground at five times the working potential. The heating is very small and considerably less than the heating of the generator itself, which is obtained by a special treatment and design of the stranded conductors. When in place they do not offer difficulties for their own safeguard and therefore are eminently suitable for installation in existing stations where the original layout did not provide for the installation of reactors Otherwise, it would be difficult to find exclusive space for the installation of larger coils and independently provide for their own safeguard.

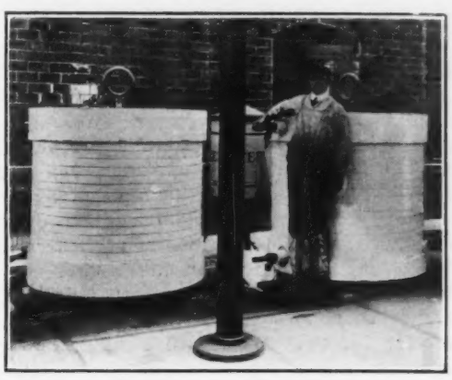


Fig. 16—900-kva, 60-Cycle, 2000-amp. Busbar Protective Reactor.

ELECTRIC ABSORPTION DYNAMOMETER.

While the engineering profession is generally familiar with the electric generator, few engineers are thoroughly acquainted with its uses as an electric absorption and transmission brake. Its value in the scientific testing of automobile engines has created a considerable demand for a laboratory instrument of this description, and, despite this fact, there are said to be only two manufacturers in the country who offer a complete equipment. In consideration of the arrangement being entirely electrical, a detailed description, relating to one of the most improved machines, may prove of interest.

Fig. 1—Regulating Resistor and Chart.

The dynamometer consists merely of a direct-current, variable-voltage generator of a special design, with a number of mechanical additions, the principal one being the arrangement for swinging the frame. This frame is circular in shape, of cast steel and fitted with compensating poles, the armature being rather long and consequently small in diameter in order to reduce the peripheral speed. Use is made of a heavy shunt winding energized by a separate source of energy at a constant potential, the field being depended upon entirely for adjustment of the braking power.

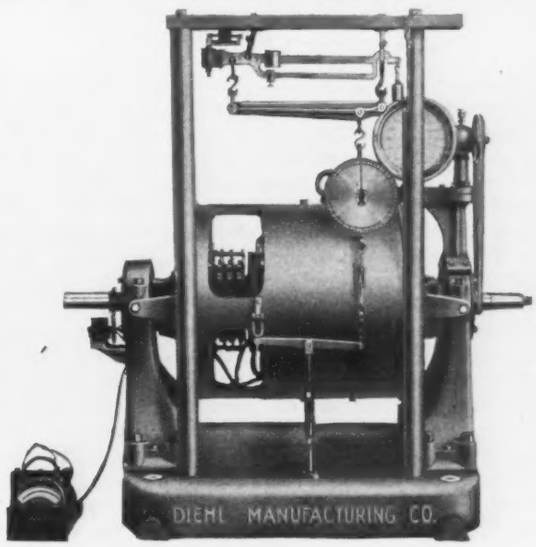


Fig. 2—Absorption Dynamometer.

Each bearing housing has a turned circular extension, which supports the complete carcass through ball bearings fitted into pedestal standards, which in turn are bolted onto the base plate, thus allowing the field frame to swing in-

dependently. The principal function of this whole swinging arrangement is to measure the torque exerted between the armature and field, which is accomplished by attaching at a given radius from the shaft center an adjustable torque link connected to a double suspension beam scale bolted securely to the stationary dynamometer base. The general equation used to ascertain the horse-power exerted at the shaft is: $2\pi RWS \div 33{,}000 = \text{hp}$, R being the radius of pull from center of shaft, S the speed in revolutions per minute, and W the weight in pounds indicated on scale. The most convenient radius of pull is 1.315 ft. from the center, which simplifies the equation to $\text{hp} = SW \div 4000$, while the still more convenient equation of $\text{hp} = SW \div 1000$ necessitates the use of a pull radius of 63 in. The torque thus measured includes all losses concerned excepting armature windage and friction of the ball bearings, which in most cases may be neglected. The speed is measured by a Hopkins electric tachometer whose magneto is geared 1 to 1 from the dynamometer shaft. The millivoltmeter used in connection with the tachometer is calibrated in two scales ranging from 0 to 500 and 0 to 2000 r.p.m. This is used in addition to a 10-in. diameter centrifugal tachometer, two instruments being preferable owing to the obvious importance of securing the correct speed.

In order to centralize the control of the engine under test,

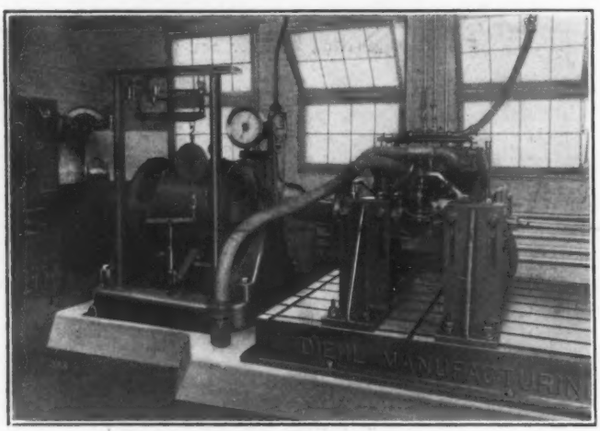


Fig. 3—Gasoline Motor Under Test.

a remote-control switchboard is used, the principal switches being of the solenoid clapper type actuated by snap switches placed on a control table. Voltmeters and ammeters are used so that the output of the dynamometer may be kept within reasonable limits, these readings being unnecessary in the final calculation. A feature is the ease and flexibility of control throughout the whole test, every adjustment being made from the master-control station, which is usually placed close to the switchboard and within good view of the torque scales on the dynamometer. It contains three remote-control switches, a large, shunt-field adjustable resistor, together with a torque and horse-power curve. In order to crank over the engine under test, the snap switch on the control panel marked "start" closes two single-pole solenoid switches, thus connecting the dynamometer directly across the circuit as a motor, through one step of the armature resistor. This provides a good cranking speed of 500 r.p m., at which point the engine starts running under its own power, the throttle and spark levers being conveniently attached to the master control table. To provide load for the engine another main solenoid switch is automatically operated, which connects a large load-absorbing resistor directly across the dynamometer terminals, through a circuit-breaker, this one action converting the brake from a motor to a generator. A special shunt-field regulator is placed under the control table, connected in series with the dynamometer field, having eighty contacts and so proportioned as to control the voltage between approximately 15 volts and 300 volts at any speed between 500 and 2000 r.p.m. The load-absorbing resistor is proportioned so that it absorbs, at the low voltage, approximately 1 hp with a maximum equal to the full capacity of the machine. In series with the eighty-step field rheostat is placed an interpolated resistor having a resistance equal to that contained between each of the main resistor steps and divided between thirty contacts, so making in all 2400 available load points. The handle controlling the large field resistor is connected to an automobile steering column, in turn keyed to the contact lever, and consists of an 18-in. diameter steering wheel with internal spark and throttle control.

Using this arrangement, the complete test may be conducted by one operator, and as the whole of the control mechanism is concentrated at one point, his undivided attention may be given to the engine under test. A feature developed especially for manufacturers of carburetors enables one to note the action of this device at the moment a car starts to descend the opposite slope of a steep hill which it has just climbed, many makers claiming that "flooding" takes place at this point. In order to produce these conditions, the dynamometer when acting as a brake to the engine should automatically become the prime mover, so producing the same effect as the rear wheels driving the engine. The change from dynamo to motor is produced by a voltage relay so introduced as to disconnect the load resistor and at the same instant connect the power circuit to the dynamometer, only, however, at that moment when both voltages are approximately equal, thus keeping the engine at the same speed.

For measuring the power absorbed by reciprocating machinery such as pumps, centrifugal blowers, grinding mills, etc., the possibilities of the electric transmission dynamometer are almost unlimited. It is an adjustable speed motor in itself, capable of a very wide speed range and of testing machines having speeds from 100 to 3000 r.p.m. It automatically shows at a glance the exact horse-power exerted at the shaft of the machine under test, no ammeter or voltmeter readings being necessary; while its speed may be finely and closely adjusted (steps of less than three revolutions being easily possible) throughout the entire range, merely by turning the rheostat handle. Steel frame and commutating-pole construction enable a large machine to be made light enough to be easily transportable. The dynamometer is made by the Diehl Manufacturing Company, Elizabethport, N. J.

REVERSING ELECTRIC MOTOR DRIVE FOR MACHINE TOOLS.

The successful application of reversing motors directly connected for driving machine cutting tools has been an objective in the minds of manufacturers for eight or ten years, though it was more or less of an experiment until recently. The use of this form of drive, even in the first stages of its development, emphasized strongly that it possessed many advantages over older methods of reversing through clutches or belt shifters. The General Electric Company has recently placed on the market a reversing adjustable-speed directly connected motor drive that has been carefully tested and tried out in service.

The motors for this service are mounted in any place on the machine or floor convenient for mechanical connection. They are of the standard commutating-pole type with a speed range of 250 to 1000 r.p.m. at 230 volts, up to and including 100-hp planer rating. These combinations of speeds allow the motor in the majority of cases to be coupled directly to the driving shaft of the machine.

The control consists of a contactor panel and master switch. The contactor panel is mounted on the side of the planer housing, or in any other convenient place. The

panel is made up of eight contactors, similar in appearance to a series contactor, but actuated by shunt, series or differential coils in such a manner as to eliminate entirely electrical disk interlocks. An additional precaution is taken by using mechanical interlocks to prevent the possibility of short-circuits.

In order not to brake dynamically from a high speed in one violent step, means have been taken to accomplish this in three distinct steps, braking slowly from high speeds and

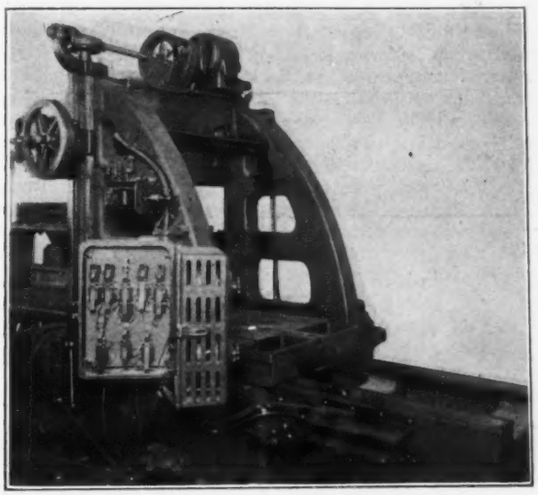


Fig. 1—A 48-in. Pond Planer, Motor Driven.

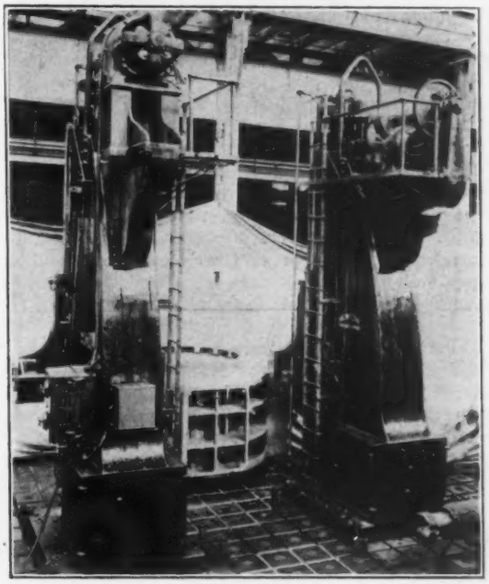


Fig. 2—Two 96-in. Newton Slotters with Reversing Motors.

then quickening the brake action at lower speeds. This could not be accomplished with one step of resistance; for at the lower speeds the braking action becomes almost nil, dragging out the process unnecessarily. The entire braking is completed in the shortest possible time without undue shock. After voltage failure with the master controller in the running position, the motor may be started by simply closing the breaker upon return of voltage to the line. Cutting and return speeds are entirely independent of each other, so that it is possible to use the slowest cutting speed and the highest return speed, or vice versa, in any combination not exceeding four to one.

The complete equipment comprises the circuit-breaker, motor, contactor control, with pendent switch if desired, master switch, two dogs, main operating lever, auxiliary operating lever and bearings for the auxiliary shaft. On account of variance in location, bends and length in individual machines, the auxiliary shaft and the connecting rods from this shaft to the operating lever and master switch are not included.

As a general proposition, the saving arising from applying power direct to machine tools is considered the amount of friction load which has thus been eliminated. This often reaches as much as 50 per cent, yet it is in reality only a part of what may be realized, as proved by numerous tests. A belt-driven planer or other machine of approximately 10-hp rating, running at a cutting speed of 25 ft. per minute, will drop in speed 2.5 ft. to 5 ft., or 10 to 20 per cent, while cutting to a value of 10 hp, if this approach the carrying capacity of the belt, owing to size, speed or slackness. If the cutting speed be increased to 50 per cent with the same depth of cut and feed, the speed will fall while cutting to nearly what it was originally, the power input increasing only slightly or to the limit of the belt capacity. The maximum slip will be reached when the machine is stalled, the power input remaining approximately constant and the loss being entirely due to friction from belt slippage. This slippage loss is demonstrated in the tabulation of tests made with a recording ammeter and given herewith. The motors used were all 230-volt machines. The speeds noted are average feet per minute for complete cutting and return strokes.

Briefly summarized the salient operating features claimed by the manufacturer for the reversing, adjustable-speed direct-connected motor drive are: maximum cutting speed sustained uniformly, affording greatly increased production; rapid acceleration on the return stroke; reverses remarkably close to a line at the end of the cut; economical operation and upkeep; any speed desired within a ratio of four to one; many speed combinations, allowing the slowest cutting and highest return speed to be combined; freedom from shocks, permitting quick reversal without jar; quiet operation; sparkless commutation, and positive and safe control of all movements of the machine within easy reach of the operator.

TESTS FOR SLIPPAGE LOSS MADE WITH RECORDING AMMETER.

Machine.		Type Drive.	Size Motor, Hp.	Input, Amp.	Cut, In.	Stroke.	Not Cutting.		Cutting.		Return.		Cut Total Cycle, Seconds.
Type.	Size.						Feet per Minute.	Time, Seconds.	Feet per Minute.	Time, Seconds.	Feet per Minute.	Time, Seconds.	
Planer.....	36 in. x 10ft.	Belt	10	33	⅜x1-16	8.5 ft.	31.9	16.0	28.3	18.0	72.8	7.0	25.0
Planer.....	36 in.x10 ft.	Reversing	10	51	⅜x1 16	8.5 ft.	53.2	9.6	52.7	9.8	91.0	5.6	15.4
Planer.....	36 in.x10 ft.	Belt	10	38.5	½x1-16	8.5 ft.	33.3	15.4	28.0	18.2	72.8	7.0	25.2
Planer.....	36 in.x10 ft.	Reversing	10	56	½x1-16	8.5 ft.	53.7	9.5	53.2	9.7	91.0	5.6	15.3
Planer.....	72 in.x22 ft.	Belt	40	95	½x1-16 1x1-16	10 ft. 1 in.	22.9	26.4	17.1	35.4	59.3	10.2	45.6
Planer.....	72 in. x22 ft.	Reversing	35	120	½x1-16 1x1-16	10 ft. 1 in.	34.8	17.4	34.4	17.6	73.7	8.2	25.8

Industrial and Financial News

REGARDED collectively, the trade situation presents a somewhat unsettled aspect at this time. While with the approach of the end of the year, with its attendant period of inventory-taking, the customary decrease in the rate at which new business is being placed is now in evidence, reports from the trade centers still indicate that the majority of business houses are having nearly all they can do to fill the orders already on their books. In numerous instances manufacturers have sufficient work on hand to keep their plants in operation at full capacity for months ahead, and in many such cases new business is not being sought or taken when offered, as the outlook for raw materials is regarded as somewhat uncertain, both as to supply and as to the prices at which they may be obtained within the next few months. There is also the tendency to withhold commitments until the scope of revision of the tariff schedules becomes more clearly defined, so as to be in a position to get such advantages as may arise from decided reductions. This feeling, being exceedingly broadcast and cumulative, is exerting a powerful retarding influence upon the entire trade situation. Among other unfavorable or retarding influences, all of which bear with varying strength upon the trade outlook, may be mentioned the European dissensions with their widespread disturbance upon the world's money markets and the temporary unsettling of conditions from the investigation of the money trust, regardless of any ultimate benefit that may arise from this source. Among the favorable elements are the continual month-to-month increases in bank clearings, the record proportions of the holiday trade in all sections, the large gains in the gross earnings of the railroads and the decrease in the number of business failures throughout the country. In the face of these cross-currents and disturbing elements, the continual expansion in the earnings of public utility and allied companies is conspicuous.

Says Centralization of Public-Utility Ownership Restricts Purchasing of Equipment to Favored Manufacturers.—Several replies to our circular letters asking for information on electrical trade conditions this year were received too late to be included in the summaries which appeared in the three previous issues. Among the belated responses are several from manufacturers of motors, all of whom report substantial increase in the volume of their business this year over that in 1911. One manufacturer reports a 15 per cent increase in volume, but states that the profits have been reduced by price-cutting on the part of the large companies in his field. He believes that economic conditions as a whole are favorable for a good volume of business next year, but he is not so optimistic as to the percentage of profits to be realized upon this volume by the smaller manufacturers. He feels that the large interests in the field dominate the price situation and place prices for motors and generators on a level where the smaller manufacturers, with relatively limited resources, cannot compete with material advantage. One effect, this manufacturer says, of the broad tendency, so much in evidence at this time, to centralize the ownership of public utilities in the hands of small groups with great financial strength is to restrict buying of electrical materials for these utilities from any but a favored few manufacturers. Along this line, he says in substance, so close is the connection in many cases between the financial interests owning or financing public utilities and those interested in the larger manufacturing companies that pressure is not infrequently brought to bear, either directly or indirectly, upon those in charge of the management of utilities to purchase the necessary equipment from the manufacturers with whom the financial groups are to a greater or less extent affiliated. Another manufacturer of motors reports a very substantial gain in the volume of his business this year and notes a growing appreciation among foreign central-station operators of the advantages accruing to them and their customers through the use of single-phase motors, as evidenced by the increased amount of this business he is receiving from abroad. He attributes the improvement in his field this year to a broader recognition on the part of central-station operators of the merits of single-phase power distribution. He considers that the greatest drawback in his field is "the fact that so many engineers in charge of the distribution of energy have either not had sufficient business experience to appreciate that the ideal, as far as distribution is concerned, may be followed only in so far as it is financially practicable, or that these same parties are not willing to take a chance and definitely ascertain the results to be secured from single-phase power distribution. I may state, however, that this condition is rapidly changing to the financial advantage of the central-station operator through the saving in cost of getting ready to serve and the saving in transmission lines and their upkeep."

Mississippi River Hydroelectric Energy for Wagner Company.—One of the interesting applications which will be made of the electrical energy transmitted from the Keokuk Dam on the Mississippi River to St. Louis will be the operation of the large manufacturing establishment of the Wagner Electric Manufacturing Company which, as is well known, is located just west of the St. Louis city boundary. The terminal station for the transmission line from Keokuk to St. Louis is placed within sight of the Wagner factory, and the work of building it is now well under way. The Wagner company has entered into contract with the Suburban Electric Light & Power Company of St. Louis for all the energy necessary for the motor operation and lighting of its group of administration, service and factory buildings. The manufacturing company has a modern power plant of its own, but this will be shut down except in winter, when the boilers will be used to supply steam for heating. Two three-phase, 13,000-volt lines will be built between the terminal station and the power plant of the Wagner company. One of these will be operated at 25 cycles and the other at 60 cycles. At the Wagner factory a wide range of current is needed for testing various classes of motors and other machinery and instruments. For instance, alternating-current motors are made for the following frequencies: 25, 30, 40, 42, 50, 60, 66 2/3, 80, 100, 125, 133 and 140 cycles. Up to and including the 66 2/3-cycle machines the motors are built for single-phase, two-phase and three-phase operation; from 80 to 140 cycles the motors supplied are of the single-phase type only. In addition the company may be called on to supply any or all of these motors for 110, 220, 440, 550, 1100 or 2200-volt operation. Thus, a supply of electricity having widely varying characteristics is needed for testing purposes alone. It may be remarked that the company is very busy and is building an extensive addition to the large general machine shop. One of the newer departments is devoted to the manufacture of electric starters for gasoline automobiles, and it is rushed with work on these interesting little machines.

Luminous Arcs for Providence, R. I.—Contracts have been awarded for the 1500 6.6-amp. luminous arcs which are to be installed in the city of Providence, R. I. Of this total, 850 are to be on ornamental iron poles and 650 are to be on ornamental brackets on wooden poles. Contracts for the lamps, regulators and rectifiers have been placed with the General Electric Company and the contract for the poles and brackets has been given to the Lundin Electric & Machine Company, of Boston. The Narragansett Electric Lighting Company, which supplies electric service in Providence and numerous other communities in Rhode Island, recently installed an 8000-kw Westinghouse-Parsons turbine in its station.

West Virginia Utility Company Enlarges Its Holdings.—The West Virginia Water & Electric Company, which was incorporated in November with $1,000,000 capital stock, has purchased the Kanawha Water & Light Company, operating in Charleston, W. Va., and formerly owned by the United States Natural Gas Company.

Growth of Copper Production.—The copper industry in the United States has shown a notable growth, according to the United States Geological Survey. In 1845, when important production of copper in this country practically began, the output was but 224,000 lb., but it increased 100 per cent the following year and gained by rapid strides until 1850, when the production was 1,456,000 lb. In 1870 it was 28,224,000 lb.; in 1890 it was 259,763,092 lb.; in 1900 it had increased to 606,117,166 lb.; in 1909 it passed the billion mark, with 1,092,951,624 lb., and in 1911 it exceeded all previous records with a production of 1,097,232,749 lb. The world's production in 1911 was 1,958,201,285 lb., of which 56 per cent was the output of the United States. It is noteworthy that, unlike areas producing most other metals, not one of the leading copper districts of the United States, several of which have been active producers for a period of thirty years or more, has been worked out or showed a marked decrease in its ability to produce copper. Twelve districts situated in eight states have each contributed over 100,000,000 lb. to the copper output of the country, or a total of 94 per cent of the whole output of the United States since 1845. Four of these districts are in Arizona, two in California and one each in Montana, Michigan, Nevada, New Mexico, Tennessee and Utah. Two districts stand out prominently, the Butte district, Montana, which has contributed over one-third of the output of the country, and the Lake Superior district, Michigan, with a production of a little less than one-third of the total output.

Montana Power Company's Personnel.—Permanent organization of the Montana Power Company, which was recently incorporated in Trenton, N. J., with a capitalization of $100,000,000, in accordance with plans outlined in these columns on Nov. 23, has been completed with the election of the following officers and directors: President, Charles W. Wetmore; vice-presidents, Max Hebgen, Charles Norman Fay, Alfred Jaretzke and Charles R. McCabe; secretary and treasurer, P. E. Bisland; assistant secretary and treasurer, Henry F. Kroyer; directors, W. S. Brayton, of East Orange, N. J.; George F. Canfield, Percy Chubb, Charles Martin Clark, Charles A. Coffin, William E. Corey, Marcus Daly, Charles Norman Fay, Alfred Jaretzke, Sydney Z. Mitchell, Charles H. Sabin, Frederick Strauss and Charles W. Wetmore, all of New York City; W. K. Wigham, London; Thomas F. Cole, Duluth, Minn.; J. G. Schmidlapp, Cincinnati; Elliott Wadsworth, Boston, and Max Hebgen, John G. Morany, John D. Ryan and William G. Thornton, all of Butte, Mont. As previously stated, extensive hydroelectric developments will be made by the company. More than 8000 hp in electrical energy will be furnished by the latter to the Butte, Anaconda & Pacific Railway, and details of a contract through which some 20,000 hp will be supplied to the Chicago, Milwaukee & St. Paul Railway are being completed. The names of the companies merged into the Montana Power Company appeared in these columns Nov. 23.

Changes in Hess-Bright Manufacturing Company.—The stock holdings in the Hess-Bright Manufacturing Company, Philadelphia, Pa., formerly owned by Mr. Henry Hess, have been purchased outright by the Deutsche Waffen und Munitionsfabriken, of Berlin, Germany. Mr. Hess has retired in order to give his attention to his various other interests. The controlling interest in the company remains in America in the hands of Mr. F. E. Bright, president and former vice-president and treasurer, who will direct the future policies of the concern. The latter is making large additions and betterments to its German works and is also improving its facilities for American distribution.

Dismiss Suit Against Evansville (Ind.) Utility Merger.—The suit brought by several citizens of Evansville, Ind., a few months ago to prevent the merger of the Evansville Public Utilities Company, the Evansville Gas & Electric Light Company and the Evansville & Southern Indiana Traction Company, on the ground that the consolidation was in violation of the anti-trust laws of Indiana and in restraint of trade, has been dismissed by Judge William Blakey of the Superior Court.

Nebraska Telephone Financing.—The Nebraska Telephone Company, of Omaha, has applied to the Nebraska State Railroad Commission for authority to issue $1,313,000 refunding bonds.

General Electric's Balance Sheet.—The general balance sheet of the General Electric Company as of Aug. 31, 1912, compares with that of Dec. 31, 1911, as shown by the following table:

ASSETS.	Aug. 31, 1912	Dec. 31, 1911
Patents, franchises and good-will	$93,398	$1
Factory, plants, etc	22,734,857	19,538,925
Real estate	749,978	448,095
Stocks and bonds	28,699,257	28,707,843
Cash	12,640,277	17,898,709
Notes and accounts receivable	16,317,731	19,098,106
Due from allied companies	5,182,611	2,891,761
Work in progress	955,397	399,708
Inventories	29,089,601	26,062,511
Consignments	.....	367,472
Total	$116,463,108	$115,399,131
LIABILITIES		
Capital stock	$77,703,200	$77,335,200
Debentures	2,437,500	2,806,000
Accounts payable	2,177,707	4,305,173
Accrued taxes	237,706	207,044
Advance payments on contracts	463,520	147,153
Accrued interest	10,851	33,014
Dividends payable	.....	1,545,654
Surplus	33,432,624	29,019,892
Total	$116,463,108	$115,399,131

Since Aug. 31, 1912, $10,000,000 more debenture bonds have been issued. The report of the company for the eight months ended with Aug. 31, 1912, showed net earnings of $7,516,037, which is equal to 9.7 per cent on the capital stock, and with a continuation of the eight months' rate net profits for the year 1912 should be equal to 14.52 per cent on the same amount of stock, as against 13.66 per cent in the year 1911. As previously stated, stockholders of the company as of Dec. 31 are to receive a stock dividend of $30 a share. This will increase the capital stock of the company to $105,000,000.

NEW YORK METAL MARKET PRICES.

	Dec. 10 Bid.	Dec. 10 Asked.	Dec. 17 Bid.	Dec. 17 Asked.
Copper:				
Standard, spot	16.87½	.....	16.75	.....
	£ s d		£ s d	
London, standard, spot	75 10 0		74 7 6	
Prime Lake	17.60 to 17.65		17.50 to 17.60	
Electrolytic	17.45 to 17.50		17.40 to 17.50	
Casting	17.25 to 17.35		17.25 to 17.50	
Copper wire, base	19.00		19.00	
Lead	4.35		4.35	
Nickel	45.00		45.00	
Sheet zinc, f.o.b. smelter	9.00		9.00	
Spelter, spot	7.37½		7.35	
Tin, spot	49.05		49.87½	
Aluminum:				
Prompt delivery	26.00 to 26.50		26.00 to 26.50	
Future	25.75 to 26.25		25.75 to 26.25	

OLD METALS.

Heavy copper and wire	16.00	16.00
Brass, heavy	10.00	10.00
Brass, light	8.50	8.50
Lead, heavy	4.15	4.15
Zinc, scrap	6.12½	6.12½

COPPER EXPORTS IN DECEMBER.

Total tons to	Dec. 11, 8,076	Dec. 18, 15,534

INDUSTRIAL SECURITIES.

Security.	Capital Stock Listed.	DIVIDEND. Per Cent.	Period.	QUOTATION. Dec. 11.	Dec. 18
Allis-Chalmers, 2d assess. paid	$17,151,100	.....	.....	2*	1⅛
Allis-Chalmers, pf., 2d assess. paid	14,034,700	.....	.....	6½	6⅛*
Amalgamated Copper	153,887,900	1	Q	74⅝	71⅝
American Tel. & Tel.	334,712,300	2	Q	137½	140
Crocker-Wheeler, c	1,700,000	1½	Q	85*	85*
Crocker-Wheeler, pf	500,000	1¾	Q	105*	104*
Electric Storage Battery, c.	16,074,425	.....	.....	53⅜	53
General Electric	77,726,700	2	Q	179½	181⅞
Mackay Cos., c	41,380,400	1½	Q	84*	82
Mackay Cos., pf	50,000,000	1	Q	67½*	66⅞
Western Union Tel.	79,943,400	¾	Q	72½	73½
Westinghouse, E. & M., c.	31,685,300	1	Q	75¼	76¾
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	121	121*

*Last price quoted.

Personal

Mr. L. A. Keene has been appointed new-business agent of the Baton Rouge (La.) Electric Company.

Mr. E. D. Charles is the superintendent of the municipal plant at Tecumseh, Neb., succeeding **Mr. F. S. Freemole.**

Mr. L. E. Butler is the successor of **Mr. A. W. Wagner** as manager of the Huron (S. D.) Light & Power Company.

Mr. James T. Watson has succeeded **Mr. C. L. Wheeler** as manager of the municipal electric-light plant at Pulaski, Tenn.

Mr. George R. Brown has been appointed manager of the Missoula (Mont.) Light & Water Company in place of **Mr. S. R. Inch,** resigned.

Mr. Henry L. Doherty was elected treasurer of the New York Academy of Sciences at the annual meeting held in New York on Dec. 16.

Mr. J. W. Mattimore has been appointed superintendent of the Consumers' Power Company, White Bear Lake, Minn., succeeding **Mr. H. B. Meacham.**

Mr. W. A. Croxton, who has been manager of the plant of the Texas Light & Power Company at Gainesville, Tex., has resigned to engage in business at Elgin, Ill.

Mr. Emerson McMillin, the well-known public-utility manager, was re-elected president of the New York Academy of Sciences at its annual meeting this week.

Mr. C. C. Henderson, president of the Henderson Light & Power Company, Greenville, Ala., was recently elected president of the Alabama Light & Traction Association.

Mr. Frank M. Tait, president of the National Electric Light Association, is scheduled to speak at a meeting of the New York Companies' Section to be held Jan. 20, 1913.

Mr. P. M. Richards has been appointed superintendent of the municipal electric-light plant and water-works at Metropolis, Ill. **Mr. G. A. Shafer** was the former incumbent.

Mr. J. W. Lieb, Jr., of the New York Edison Company, will lecture on "Rates" at the monthly meeting of the New York Companies' Section, N. E. L. A., to be held Feb. 19, 1913.

Mr. A. W. Lindgren has resigned his position as manager and superintendent of the Huntington Beach (Cal.) Electric Light & Power Company. His successor is **Mr. H. L. Heffner.**

Mr. W. E. McFadden, formerly connected with the Kansas district of the General Electric Company, has been appointed manager of the Salina (Kan.) Light, Power & Gas Company.

Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago, Ill., together with Mrs. Insull and their son, sailed on the S.S. *Mauretania* for England on Dec. 17.

Mr. George F. Brockman, formerly connected with the Public Service Company of Northern Illinois, has been appointed superintendent of the municipal lighting plant at Herington, Kan.

Mr. F. O. Dolson, formerly connected with the engineering department of the Pelton Water Wheel Company, has entered the employ of the Pacific Power & Light Company of Portland, Ore.

Mr. H. G. Overbeck has been appointed secretary, treasurer and general manager of the Glenwood Light & Water Company, Glenwood Springs, Col., in place of the late Mr. F. H. A. Lyle.

Mr. Nelson B. Hazeltine has been appointed Philadelphia manager of the Adams-Bagnall Electric Company as successor to **Mr. R. C. Campbell,** who went to London for the General Motors Company.

Mr. R. S. Johnston, who succeeded **Mr. W. C. Duncan** as new-business manager at Lawrence, Kan., has been transferred to the commercial department of the Parsons (Kan.) Railway & Light Company.

Mr. Irving P. Lord, president and general manager of the Waupaca (Wis.) Electric Light & Railway Company, has become practically the sole owner of the property, having bought out the other shareholders.

Mr. W. R. Molinard, general manager of the Oklahoma Gas & Electric Company, Oklahoma City, Okla., addressed the local Chamber of Commerce earlier in the month on the subject of "Industrial Suggestions."

Mr. L. J. Geer, who for the past thirteen years has been connected with the Texas Light & Power Company at Gainesville, Tex., as chief engineer and superintendent, has been promoted to the position of manager.

Mr. Harry D. Falls, for many years secretary, treasurer and manager of the Brazil (Ind.) Electric Company, has been appointed superintendent of the Terre Haute, Indianapolis & Eastern Traction Company at Brazil.

Mr. B. E. Blanchard, associate editor of *Popular Electricity,* addressed the Electric Club of Chicago on Dec. 12 on some of the marvels of latter-day electricity. The talk was illustrated and was an interesting popular exposition.

Prof. John A. Hunter of the mechanical-engineering department, University of Colorado, Boulder, Col., spoke before the Dec. 12 meeting of the Colorado Electric Club, Denver, on the subject of "Engineering Efficiency."

Mr. Stuart Wilder has been appointed electrical engineer for the Westchester (N. Y.) Lighting Company, succeeding to the position made vacant by the recent death of Mr. J. T. Cowling. Mr. Wilder was Mr. Cowling's assistant.

Mr. Arthur Williams, of the New York Edison Company, has been appointed by Mayor Gaynor of New York a member of the committee of one hundred which is to arrange next fall for the celebration of the 300th anniversary of the settlement of Manhattan Island.

Mr. Charles Piez, president of the Link Belt Company, of Chicago, was elected president of the Illinois Manufacturers' Association at the recent annual meeting. At the same time **Mr. E. N. Hurley,** of the Hurley Machine Company, was chosen as second vice-president.

Mr. J. D. Murphy, formerly contract agent and superintendent of the Hoisington (Kan.) Electric & Ice Company, has been made manager of that company and also of the Great Bend Water & Electric Company. Mr. Murphy will make his headquarters at Great Bend, Kan.

Mr. Edwin Gruhl, New York, assistant to the president of the North American Company, has been appointed a member of the rate-research committee of the National Electric Light Association. Mr. Gruhl was formerly chief statistician for the Wisconsin Railroad Commission.

Mr. C. N. Garland, late of the R. D. Wood Company of Philadelphia and formerly of the faculty of the University of Illinois, has joined the firm of Woodmansee, Davidson & Sessions, consulting engineers of Chicago, Ill. Mr. Garland has specialized in combustion engineering.

Mr. S. R. Inch, for several years manager of the electric light and street railway properties at Missoula, Mont., has resigned his position, to take effect Jan. 1, 1913, in order to accept the post of general superintendent of the Utah Power & Light Company at Salt Lake City, Utah.

Mr. C. F. Richardson, superintendent at Brazil, Ind., of the Terre Haute, Indianapolis & Eastern Traction Company, has severed his connection with that company and accepted the position of general manager of the Southern Illinois Railway & Power Company at Harrisburg, Ill.

Mr. George D. Rosenthal, of St. Louis, district manager for the General Electric Company, has been suggested as a candidate for Mayor of St. Louis by the *Mirror* of that city. This paper says that "Mr. Rosenthal is being favorably considered all over town as a man who would 'get something done.'"

Mr. Charles F. Prichard, vice-president of the Lynn Gas & Electric Company, Lynn, Mass., recently delivered a lecture on "Gas: Its Manufacture, Uses and Possibilities" at a meeting of the members of the American Institute of Electrical Engineers in that city. The lecture was given at Burdett Hall.

Mr. Harvey C. Garber, for many years an official of the Central Union Telephone Company, one of the Middle West subsidiaries of the American Telephone & Telegraph Company, has resigned to become vice-president of the Ralston Steel Car Company, of Columbus, Ohio, with headquarters in New York City.

Mr. W. G. Chace, of Messrs. Smith, Kerry & Chace, Toronto, Ont., has succeeded the late Mr. C. B. Smith as president of the Crane Falls Power & Irrigation Company, Ltd., which is building a 12,000-hp hydroelectric station and a 7000-hp substation near Boise, Idaho, to supply electrical energy for irrigation purposes.

Mr. F. N. Boyer, assistant district manager of the General Electric Company in Chicago and one of the most widely known of the electrical men of the West, left on Dec. 17 for an extended vacation in southern California. Mr. Boyer has not been in the best of health of late, and his trip is partly for rest and recuperation.

Mr. Fred J. Neagle, formerly with the Blackstone Valley Gas & Electric Company of Pawtucket, R. I., was presented with a gold watch by his office associates recently when he resigned from the company to accept the position of assistant treasurer of the Electric Light & Power Company of Abington & Rockland, North Abington, Mass.

Mr. Samuel E. Edwards has resigned from the Indiana Lighting Company, of Lafayette, Ind., and purchased a third interest in the Wolever Electric Company, electrical contractor, Lafayette. Mr. Edwards was in the employ of the lighting company for eighteen years, and at the time of his resignation was manager of all outside work of the company.

Mr. R. E. Brown, manager of the Consumers' Electric Company at Mankato, Minn., was elected chairman of the reception committee which will entertain Governor Eberhart on a forthcoming visit. Mr. Brown several years ago served the Minnesota Electrical Association as acting president, and he was recently chosen president of the Mankato Automobile Club.

Mr. Arthur Tuttle, who was chief accountant for the United Water, Light & Traction Company, of Somerset, Ky., has been appointed auditor of the Kentucky Utilities Company. The latter corporation was recently organized with $5,000,000 capital and has acquired electric-lighting properties at Somerset, Versailles, Elizabethtown and other points. Its Kentucky headquarters are at Lexington.

Mr. Edward B. Ellicott, who has been electrical engineer for the Sanitary District of Chicago for several years, was re-elected to that position on Dec. 13. At the same time **Mr. Lyman E. Cooley** was elected as consulting engineer in place of **Mr. Isham Randolph,** resigned. The recent election changed the political complexion of the board of trustees, but Mr. Ellicott was retained without reference to politics.

Mr. George B. Foster, of the president's office of the Commonwealth Edison Company, Chicago, has been bereaved by the recent death of his mother, Mrs. Mary C. Foster, who died this month at the age of sixty-eight years. Mrs. Foster was a native of Chicago and had lived in that city all her life. Her father, Cyrenius Beers, was one of the first settlers in Chicago and a member of the first City Council.

Mr. John Hunter, chief engineer of power plants of the Union Electric Light & Power Company of St. Louis, has been elected president of the Engineers' Club of St. Louis. This organization, which is one of the oldest engineering clubs in the country, has 350 members. With it are affiliated the local members of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Society of Engineering Contractors.

Mr. E. B. Greene, general manager of the Penn Central Light & Power Company, Altoona, Pa., recently celebrated the twenty-ninth anniversary of his entrance into the electrical business. Mr. Greene began as an employee of the Bellefonte (Pa.) Electric Light Company, and for a great many years was in charge of the Edison Electric Illuminating Company of Altoona prior to its absorption by the present company. He succeeded **Mr. E. T. Penrose** as general manager of the Penn Central Light & Power Company early this year.

Mr. E. D. Smith, until recently chief engineer of the Board of Education of St. Louis and formerly superintendent of power stations for the United Railways Company of St. Louis, is now superintendent of the Mississippi River Power Distributing Company, which is the local company distributing in St. Louis and its environs electrical energy received from the hydroelectric development on the Mississippi River at Keokuk, Ia. Mr. Smith is a graduate of the electrical engineering department of the University of Missouri, class of 1901.

Mr. Ferdinand Charles Schwedtman, of St. Louis, Mo., who on Dec. 17 with eight others was appointed on the recently created United States Commission on Industrial Relations, was born in Osnabrück, Germany, May 13, 1867. He was educated at Hanover, Germany, and Amsterdam, Holland, and at Cooper Union, New York City, having come to the United States in 1881. He was chief engineer of the Missouri Electric Light & Power Company from 1889 to 1899 and was founder and general superintendent of the Wagner Electric Manufacturing Company of St. Louis from 1891 to 1904. He is also president of the Louisiana Contracting Company, and has a number of electrical and mechanical inventions to his credit. Mr. Schwedtman is now president of the Citizens' Industrial Association and also vice-president of the National Association of Manufacturers.

Mr. William Brown Dickson, who was elected president of the International Steam Pump Company recently, was born in Pittsburgh, Pa., Nov. 6, 1866. In 1881 he secured employment in the Homestead Steel Works and after passing several years at manual labor in the mills was transferred to the office, acting at first in a clerical capacity and subsequently receiving rapid promotion through various grades up to that of assistant to the president and managing director of the Carnegie Steel Company. Mr. Dickson became a junior partner in the Carnegie Steel Company, Ltd., in 1899 and on the formation of the United States Steel Corporation in 1901 accompanied Mr. C. M. Schwab to New York as assistant to the president of the United States Steel Corporation. Later he was elected a vice-president of that corporation, which position he held until May 1, 1911, when he retired from active business. Mr. Dickson succeeds the late Benjamin Guggenheim, who went down with the ill-fated *Titanic*.

Obituary

Mr. Herman Samuels, member of the Baltimore contracting firm of the Kingsbury-Samuels Electric Company, died suddenly on Friday, Dec. 13. He was prominent in fraternal circles and took much interest in the Baltimore Electrical Contractors' Association. He was in his fifty-fifth year.

Mr. Alfred P. Boller, president of the American Institute of Consulting Engineers and a former vice-president of the American Society of Civil Engineers, died at his home in East Orange, N. J., on Dec. 9. Mr. Boller was formerly chief engineer of the Manhattan Elevated Railway and consulting engineer of the Department of Public Parks of New York City.

Mr. Henry F. Coggshall, for many years manager of the Fitchburg (Mass.) Gas & Electric Light Company, died at his home on Dec. 14 after a short illness. Mr. Coggshall was eighty-eight years of age and was associated with the local gas company from its foundation in 1853, his managership, which later came to include the electric service of the organization, extending from that year to 1909, when the property passed into the hands of the Tenney interests of Boston.

Mr. Paul H. Bate, one of the best known of the solicitors of the contract department of the Commonwealth Edison Company, died at his home in Western Springs, Ill., near Chicago, recently. Mr. Bate was a patent lawyer by profession and his early life was spent in New York, where he practised for a number of years. He went to the Chicago Edison Company, as it was then called, in 1900 and since 1904 had been connected with the isolated-plant division of the contract department of that company. Mr. Bate achieved something of a national reputation among electrical men in 1908, when he was awarded the first prize of $500 by the Co-operative Electrical Development Association, working in conjunction with the National Electric Light Association, for his contribution offered, in a competition, as the basis of the power section of the "Solicitor's Handbook."

Construction

CULLMAN, ALA.—The city expects to purchase within the next six months a carload of 30-ft. and 35-ft. poles and some lightning arresters and also expects to renew contract for incandescent lamps within the next four months. B. Kiel is superintendent of the municipal electric-light and water plant.

COTTON PLANT, ARK.—The Cotton Plant Lt. & Pwr. Co. contemplates within the next 12 months the erection of 60 poles and 5000 ft. of line wire, and the purchase of one 100-hp Corliss engine within the next 10 months; also within the next two months it expects to purchase one boiler-feed pump for 125-hp boiler. Within the next 12 months the company expects to purchase 50 meters, six lightning arresters, 5000 ft. No. 8 insulated wire and four transformers. J. L. Diamond is superintendent.

SULPHUR SPRINGS, ARK.—The plant of the Sulphur Springs El. Lt. Co. was recently destroyed by fire, causing a loss of about $12,000. The city is at present without electrical service. J. H. Bexten, of Omaha, Neb., is president of the company.

BURBANK, CAL.—The Pacific Lt. & Pwr. Co. is planning to erect a transmission and distribution line to Burbank, a distance of about 10 miles. The proposed line will carry 10,000 volts.

DOWNIEVILLE, CAL.—C. J. York, proprietor of the Downieville foundry, has purchased the interests of William Dubuque and M. A. Costa in the Downieville El. Lt. Co. and is now sole owner of the property.

LOS ANGELES, CAL.—The Pacific Lt. & Pwr. Corpn. has purchased the electric distributing system of the Eagle Rock Water Co.

LOS ANGELES, CAL.—Sealed bids will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until Jan. 22, 1913, for furnishing hydraulic and electrical apparatus for St. Mary's storage unit, Milk River project, Montana. For particulars address United States Reclamation Service, 605 Federal Building, Los Angeles, Cal., or Washington, D. C. A. P. Davis is acting director.

NORDHOFF, CAL.—The State Railroad Commission has authorized the Ojai Pwr. Co. to issue $25,000 in capital stock, the proceeds to be used for the construction of an electric-light plant in Nordhoff. The company was also granted a certificate of public convenience and necessity to exercise its franchise rights.

OCEANSIDE, CAL.—The Oceanside El. & Gas Co. contemplates the purchase of one 100-hp horizontal tubular boiler, 140-lb. pressure, within the next six months; also expects to purchase within two months switchboard equipment for 150-kw, 11,000-volt transmission line and material for a 10-mile, 11,000-volt transmission line for irrigating plants of 5 hp to 25 hp, including motors, meters, transformers, three-phase, 60-cycle. Eugene V. Griffes is manager.

RED BLUFF, CAL.—The Tehama County Pwr. & Transportation Co. has sold all its water rights on Mill Creek in Tehama County to the Northern California Pwr. Co., of San Francisco.

RIVERSIDE, CAL.—The County Supervisors have granted the Pacific El. Ry. Co. a franchise to construct a line on Magnolia Avenue from the city limits westward to Corona.

STOCKTON, CAL.—The Oro El. Corpn., of Oroville, has applied to the Board of Supervisers of San Joaquin County for a blanket franchise for a pole line in this county. This franchise is sought to enable the Oro company to supply electricity to farmers in various parts of the county. Bids will be received for the franchise until Jan. 7.

LIMON, COL.—The Lincoln County Ice & El. Co., recently incorporated, will begin work immediately on the construction of a plant in Limon. The first installation will consist of two 100-kw electric generating units and a 10-ton ice plant. The company contemplates extending its service to several small cities in eastern Colorado, where franchises have been promised. The general offices of the company are located at 509 Colorado Building, Denver. Albert C. Jahl is general manager.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Dec. 28 for equipment for one 5-kw radio station in accordance with Signal Corps specification No. 566, under Proposal No. 630. Captain W. L. Clarke is disbursing officer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 7, 1913, for furnishing at the navy yard, Brooklyn, N. Y., the following supplies as per Schedule 5065: Miscellaneous composition pipe fittings and miscellaneous copper seamless drawn tubing; Schedule 5060—20 long-burning arc lamps; 255 steel reflector fixtures, etc. Applications for proposals should give the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

ORLANDO, FLA.—Bonds to the amount of $10,000 have been voted to purchase the electric equipment from the Orlando Wtr, & Lt. Co. J. Lloyd Minnis will have charge of the installation of the new system.

DOERUN, GA.—J. B. McCrary & Co., of Atlanta, Ga., have purchased a $12,000 bond issue recently voted by the city of Doerun for improvements to lighting and power system here.

ELBERTON, GA.—R. C. Turner, city electrician of Atlanta, Ga., who was engaged by the City Council to make an investigation of the municipal electric-light plant, has recommended the erection on a site on the railroad of a steam generating plant which can be operated independently of the water-power plant. The cost of the plant is estimated at about $12,000.

SYLVESTER, GA.—The municipal electric-light plant has been enlarged recently, at a cost of about $16,836. O. E. Green is superintendent.

ASHTON, IDAHO.—Former United States Senator W. A. Clark, of Montana, has purchased a power site on the north fork of the Snake River near Ashton. It is understood that a hydroelectric power plant will be built and transmission lines erected into Montana and Idaho at a cost of about $750,000,

BOISE, IDAHO.—The Southern Idaho Lt. & Pwr. Co. and the Idaho Trac. Co. are planning to make extensive improvements to their systems in this city.

CALDWELL, IDAHO.—The Mountain States Tel. & Teleg. Co. is planning to reconstruct its toll and service lines in the city of Caldwell and vicinity. Several extensions into the country are planned. The cost of the work is estimated at about $75,000.

POCATELLO, IDAHO.—Application has been made to the City Council by J. D. Browning, of Pocatello, and L. R. Martineau, of Salt Lake City, Utah, for two franchises in Pocatello. Both are for a term of 50 years. The first is for the installation of an electric-lighting system and the other for a street railway.

CHICAGO, ILL.—Sealed proposals will be received by Ray Palmer, city electrician, Room 608, City Hall, Chicago, until Dec. 27, for furnishing the city of Chicago with lamps on certain parts of streets in different sections of the city for one year from Jan. 1, 1913, as per specifications on file in the office of the city electrician. Proposals must be made out on blanks furnished by said official.

CHICAGO, ILL.—Sealed proposals will be received by Ray Palmer, city electrician, 608 City Hall, Chicago, Ill., until Dec. 27, for furnishing and delivering to the Department of Electricity, city of Chicago, sundry material and supplies for the year 1913, strictly in accordance with specifications on file and samples which can be seen in the office of said official, and in approximately the following quantities: 875 doz. outer globes for arc lamps; 1300 doz. inner globes, heat resisting, for arc lamps; 600 doz. 16-cp incandescent lamps; 16,000 100-watt series tungsten lamps; 50 doz. 40-watt tungsten lamps for three-wire circuits; 100,000 incandescent mantles; 150 gross mica chimneys; 700 boxes glass "sides" (44 lights in a box); 400 boxes glass "tops" (64 lights in a box); 50 boxes glass "doors" (54 lights in a box). Proposals must be made upon blanks furnished by the city electrician.

CHICAGO, ILL.—Sealed proposals will be received by Ray Palmer, city electrician, 608 City Hall, Chicago, Ill., until Dec. 27, for furnishing the Department of Electricity, city of Chicago, Ill., with arc-light carbons for electric use, strictly in accordance with the specifications on file in the office of said official and in approximately the following quantities: 480,000 14-in. by 5/16-in. copper-coated carbons; 100,000 12-in. by 1/2-in. copper-coated carbons; 140,000 12-in. by 0.510-in. to 0.520-in. solid high-grade carbons; 140,000 12-in. by 0.510-in. to 0.520-in. cored high-grade carbons; 40,000 12-in. by 0.510-in. solid high-grade carbons, special gage; 12,000 pairs white-flame carbons for Stave arc lamps, upper carbon dimensions 10 1/4 in. by 20 mm, lower carbon dimensions 8 3/4 in. by 18 mm; 365,000 12-in. by 7/16-in. white-flame carbons for G. E. Lynn arc lamps. Proposals must be made out on blanks furnished by the city electrician.

MATTOON, ILL.—The Central Illinois Pub. Ser. Co., recently incorporated, has taken over the following plants: Fruit Growers' Refrigerating & Pwr. Co., of Anna; Central Ice Co., of Mounds; Citizens' Wtr., Lt. & Pwr. Co., of Carbondale; Interurban El. Co., of Carterville; Interurban El. Co., of Herrin; Fruit Growers' Refrigerating & Pwr. Co. and Marion Lt., Pwr. & Wtr. Co., of Marion; Johnson City El., Gas & Wtr. Co., of Johnson City, and People's Lt., Wtr. & Pwr. Co., of Harrisburg. The new company proposes to supply electrical service to various districts from one large central plant, distributing electricity in small towns where the patronage warrants. The general offices of the company are located in Mattoon.

MURPHYSBORO, ILL.—The City Council is contemplating a change in the street-lighting system.

MURRAYVILLE, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, is negotiating with the Village Board and will probably seek a franchise to distribute electricity in Murrayville. A transmission line will be erected from the plant at Roodhouse.

OREGON, ILL.—Arrangements are being made by the business men for the installation of boulevard lamps here. It is proposed to erect the lamps in both the residence and the business districts.

PERU, ILL.—The contract for the installation of a new turbine engine and other equipment has been awarded to the Westinghouse El. & Mfg. Co. for $10,690. The area lighted by the city will be increased.

ROCK ISLAND, ILL.—The voters have approved a proposition to grant a 25-year franchise to the Tri-City Automatic Tel. Co. to operate a telephone system in Rock Island. The company already has a franchise to operate in Moline, Ill., and the proposition has been ratified by the voters of Davenport, Ia., but it must be passed upon by the Davenport Council.

ANDERSON, IND.—Residents in North Anderson have filed a petition with the City Council asking for electric-light service in that district.

CONNERSVILLE, IND.—The Hydro-Electric Lt. & Pwr. Co. expects to erect within the next few months a boiler room and install two 250-hp Sterling water-tube boilers, one 500-kw Allis-Chalmers turbo-generator, boiler-feed pump, surface condenser with necessary pumps, generator and exciter panel with necessary instruments. Machinery has already been purchased.

INDIANAPOLIS, IND.—The Merchants' Ht. & Lt. Co. expects to purchase within the next eight months one 10,000-kw turbo-generator and eight 500-hp boilers. E. Darrow is manager.

ROCKVILLE, IND.—The installation of a Chandler & Taylor 100-hp boiler in the municipal electric-light plant has been completed. B. H. Freeland is superintendent.

TERRE HAUTE, IND.—The Terre Haute, Indianapolis & Eastern Traction Co. has been granted a franchise by the Commissioners of Vigo County to erect transmission lines over all the public highways in the county. The company proposes to extend transmission lines to the coal fields and supply electricity to the mines for lamps and motors; also to several towns along the route.

WINONA, IND.—The Winona El. Lt. & Wtr. Co. is planning to erect additional transmission lines and install additional generators or turbines. The street-lighting system in Warsaw will be changed. Theodore C. Frazer is manager.

ARMSTRONG, IA.—The Armstrong Cement Works has awarded contracts for the installation of an electric light and power plant as follows: To the Murray Iron Works, of Burlington, Ia., for engine, boiler, feed-water heater and pump; to the Electrical Machinery Co., Minneapolis, Minn., for one 75-kva, three-phase alternating-current generator and three-panel switchboard; to Page & Hill, Minneapolis, Minn., for poles; to the Electric Appliance Co. for Packard transformers, Sangamon meters and line material. The plant will be put in operation about Feb. 1. Ageton Brothers, of Estherville, Ia., have charge of construction of plant. P. H. Atwood is manager.

BUFFALO, IA.—H. C. Blackwell, superintendent of the Tri-City Ry. & Lt. Co., has submitted a proposition to the Town Council for furnishing electricity for lighting the town.

DES MOINES, IA.—Carl Scholz, manager of the mining department of the Rock Island lines, is interested in a company which proposes to erect an electric power plant to supply electricity for industrial purposes in Des Moines. The plant will be erected near the mines of the railroad between Dallas and Melcher on the St. Paul & Kansas City Short Line, about 18 miles south of Des Moines, at a cost of about $200,000. About 16,000 hp will be transmitted to Des Moines. If present plans are carried out, work on the proposed plant will begin in the spring.

KEOKUK, IA.—The Keokuk El. Co. has completed its substation and expects to change over to hydroelectric power within the next six months. The steam plant will be abandoned. The entire town has been rewired preparatory to changing to 25-cycle system. A. D. Ayres is manager.

MARCUS, IA.—At an election held recently the proposition to grant K. C. Gaynor, of Sioux City, a franchise to install an electric light and heating plant was carried. The cost of the proposed plant is estimated at about $15,000.

OAKVILLE, IA.—The town has voted to grant a franchise to R. B. Vaught, of Burlington, Ia., to supply electricity for lamps and motors in Oakville.

RED OAK, IA.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 21, for construction, including plumbing, gas piping, heating apparatus, electric conduit and wiring, interior lighting fixtures and approaches, of the United States post office at Red Oak, Ia. Drawings and specifications may be obtained from the above office or from the custodian of site at Red Oak. Oscar Wenderoth is supervising architect.

WHITING, IA.—Bonds to the amount of $10,000 have been voted for the installation of a municipal electric-light plant.

CEDAR POINT, KAN.—The Town Council is securing estimates of the cost of the installation of a municipal electric-light plant in Cedar Point. It is expected that an election will soon be called to vote on the proposition to issue bonds for same.

DODGE CITY, KAN.—The Midland Wtr., Lt. & Ice Co. expects to purchase within the next two months one carload of poles. A. E. Abenhaus is cashier.

MOLINE, KAN.—The proposition to issue $50,000 in bonds for construction of an electric-light plant and water-works system will be submitted to the voters in the near future. The Benham Engineering Co., American National Bank Building, Oklahoma, Okla., has been engaged by the city to prepare plans for the proposed work.

OTTAWA, KAN.—Sealed bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 18, for the construction, including plumbing, gas piping, heating apparatus, electric conduit and wiring and lighting fixtures, of the United States post office at Ottawa, Kan. Drawings and specifications may be obtained at the above office or from the custodian of site at Ottawa, Kan. Oscar Wenderoth is supervising architect.

TOPEKA, KAN.—The output of the Topeka Edison Co. will be increased from 25 to 30 per cent by the installation of additional equipment during the next year. W. B. McKinley, of Champaign, Ill., is president of the company and A. H. Purdy, of Topeka, general superintendent.

COVINGTON, KY.—The City Council is investigating the feasibility of establishing a municipal electric-light and power plant here.

ELIZABETHTOWN, KY.—The Kentucky Utilities Co., of Louisville, has taken over the property and holdings of the Elizabethtown El. Lt. Co., which was purchased some time ago. Extensive improvements are to be made to the local plant.

HENDERSON, KY.—The city of Henderson expects to erect a chimney 250 ft. high by 12 ft. 6 in. in diameter at the municipal electric-light plant and to purchase one 750-kw turbine and two 400-hp water-tube boilers, 200 arc lamps, transformers and rectifiers for metallic-flame or magnetite street-lighting system. L. P. Hite is superintendent.

LEXINGTON, KY.—The Lexington Utilities Co. expects to purchase within the next few months irons, toasters, curling irons, motors, etc., for its electrical appliance and supply department. Eugene Creed is business manager.

VERSAILLES, KY.—The franchise to erect transmission lines for the distribution of electricity for lamps and motors on the Versailles and Midway, the Versailles and Shryock's Ferry and the old Lexington and Frankfort turnpikes in Woodford County, which was offered at public sale, was purchased by Harry Reid for the Kentucky Utilities Co., of Louisville, for $50.

NEW ORLEANS, LA.—Sealed proposals will be received by F. S. Shields, secretary, at the office of the Sewerage and Water Board, Room 508, City Hall Annex, New Orleans, La., until Feb. 18, 1913, for work to be executed under contracts "49-D" and "52-D" respectively, transmission line and power cables for drainage system. Approximate quantities of each contract as follows: "49-D"—230 square cypress poles; 72,000 ft. 350,000-circ. mil insulated conductor; 75,000 ft. No. 0000 insulated conductor. "52-D"—21,000 ft. lead-covered or armored cable. George G. Earle is general superintendent.

SHREVEPORT, LA.—The City Council has granted the Louisiana-Texas Trac. Co. a franchise to build terminal properties and to use streets in connection with an interurban electric railway. The company proposes to build an electric railway between Shreveport and East Texas points.

CANTON, MAINE.—Estimates of the cost of installing an electric-light system in Canton, energy to operate the system to be supplied from Livermore Falls plant, have been submitted by John H. Maxwell, president of the Livermore Falls Lt. & Pwr. Co.

KEZAR FALLS, MAINE.—The Kezar Falls Lt. & Pwr. Co. was wrecked recently by water undermining the bulkhead. It is understood that the power house will be taken down and rebuilt next spring as soon as the weather will permit. Electricity for lamps is now being furnished by the Kezar Falls Woolen Co.

ATHOL, MASS.—The Athol Gas & El. Co. has recently completed an addition to its power house and has installed one 450-hp Sterling water-tube boiler, one General Electric 500-kw steam turbine and additional switchboard equipment for above machine.

FALL RIVER, MASS.—The Board of Aldermen has granted the Southern Massachusetts Pwr. Co. a franchise to lay conduits in the streets of the city for carrying electric wires, in order to extend and improve the electric light and power service in the city.

FITCHBURG, MASS.—The County Commissioners have decided to install an electric-lighting system at the South Fitchburg house of correction to replace the gaslight system now in use.

MARLBORO, MASS.—The Marlboro El. Co. expects to purchase this month three 150-kva, 13,000-6900 volt transformers and one 20-kva pole-type regulator with necessary circuit breaker, switches, etc. It also expects to erect a concrete garage, 45 ft. by 27 ft., to accommodate four cars. D. W. Halliday is general manager.

NORTH ATTLEBORO, MASS.—The North Attleboro Electric Light & Water Department expects to purchase within the next 12 months two 250-hp water-tube boilers, one 300-kw steam turbine and one 500-kw steam turbine. The company has purchased electrical energy from the Union El. Lt. & Pwr. Co., of Franklin, Mass., since Sept. 1. William Plattner is manager.

WARREN, MASS.—The Warren Pwr. Co., which proposes to construct a hydroelectric plant near West Warren and Palmer, would like to communicate with manufacturers of wooden stave pipe (California redwood or other wood), 7 in., 8 in., 9 in. and 10 in. in diameter; also with manufacturers of the Diesel oil engines. The officers of the company are located at 62 Stebbins Street, Springfield, Mass. John T. F. MacDonnell is treasurer.

ALBION, MICH.—A committee has been appointed by the Mayor to take up the question of installing a modern street-lighting system in the business district.

ANN ARBOR, MICH.—Contracts have been awarded by Smith, Hinchman & Grylls, architects, for the new power house for the University of Michigan, for the erection of the building and installation of equipment amounting to $256,000 as follows: To the Newton Engineer Co., of Milwaukee, Wis., for construction of building and the tunnel connecting the power house with the several campus buildings, the hospitals and the Hill Memorial, for installation of the boilers to the Wickes Boiler Co., of Saginaw, and for steel work to the Toledo Steel Co. Other contracts will be awarded later. The new power house will be erected in the "cat-hole district."

BAY CITY, MICH.—Sealed proposals will be received by the Electric Light Department of the city of Bay City, Mich., until Jan. 2, 1913, for turbo-generator, switchboard, condenser, water-tube boilers and attachments, in accordance with specifications on file in the office of the said department.

BOYNE CITY, MICH.—The W. H. White Co. is building a new power plant for the purpose of increasing the steam capacity of Mill No. 1 and the flooring plant. A 350-hp boiler is being installed at the flooring plant.

DETROIT, MICH.—The Morgan & Wright Co. is enlarging its works and will install new equipment in the power plant, doubling the boiler capacity.

DETROIT, MICH.—The Detroit United Railway Co. is preparing to double-track its railway from Detroit to Mount Clemens, work to start in the spring.

GREENVILLE, MICH.—The R. J. Tower El. Co. contemplates the reconstruction of dam and the purchase of additional waterwheels within the next 12 months. R. J. Tower is manager.

HILLSDALE, MICH.—The Board of Public Works expects to purchase stokers, coal and ash handling machinery system within the next 12 months for the municipal electric light and water plant. J. C. Hanson is manager.

KALAMAZOO, MICH.—Work will begin in the spring on the removal of all overhead wires on Water Street. An underground conduit system will be installed.

MUSKEGON, MICH.—The Shaw-Walker Co., which is erecting a four-story building for the manufacture of furniture, will soon be in the market for electrical equipment.

PETOSKEY, MICH.—The city of Petoskey expects to purchase within the next 12 months a set of automatic stokers for three boilers in the municipal electric-light plant. John W. Lovelace is city electrician.

PONTIAC, MICH.—The Pontiac Pwr. Co. has received authority from the State Railroad Commission to issue $5,000 in bonds, the proceeds to be used for improvements and extensions to the local power plants.

WYANDOTTE, MICH.—The Detroit Valve & Fitting Co. is reported to be in the market for a 250-kw direct-current generator.

BEMIDJI, MINN.—The Warfield El. Co. contemplates the purchase of one 500-hp Corliss engine direct-connected to 500-kw generator and a condenser within the next six months. A. A. Warfield is secretary.

FULDA, MINN.—The Fulda Lt. & Pwr. Co. contemplates making improvements to its plant and erecting transmission lines to Kinbrea and Dundee.

LAKE CITY, MINN.—The Board of Water and Light Commissioners of Lake City may change its system from alternating current, 110-220-2300-volt, single-phase, to three-phase, and may possibly purchase within the next 12 months two tub transformers, 50 lamps each, for magnetite or similar lamps to replace the open arc lamps now in use. The erection of a water tank or construction of a reservoir of from 200,000 gal. to 300,000 gal. capacity within the next 12 months is contemplated. J. Cole Doughty is president of the board.

MINNEAPOLIS, MINN.—The City Council has authorized Dr. Hall to offer the Park Board electricity generated at the garbage disposal plant to light Camden and Fairview Parks at $60 per lamp per year and 3 cents per kw-hr. for other service. Inspectors Allen and Frank Overholt and Superintendent J. E. Anderson were directed to confer with Andrew Rinker, city engineer, on plans to utilize for electric lighting purposes the water-power near St. Anthony Falls owned by the city.

NORTH ST. PAUL, MINN.—The State Board of Investment has approved the application of the town of North St. Paul for a loan of $8,000 with which to make repairs to its electric-light and water plant.

OWATONNA, MINN.—Preparations are being made for the installation of a new street-lighting system to cost about $8,500. The plans provide for the erection of 50 cast-iron posts carrying 6.6-amp inverted magnetite arc lamps. The underground work includes the laying of 2-in. loricated conduit. No. 6 lead-incased, rubber-covered wire (seven-strand) will be used. The conduit will be laid by day labor and it is expected that the rest of the work will be done in the same way. Lamps and posts are yet to be purchased. Harvey S. Dartt, city engineer.

MONTICELLO, MISS.—Bids will be received until Jan. 7, 1913, by J. H. Teunisson, clerk of board of supervisors of Lawrence County, Monticello, Miss., for heating, lighting and plumbing work in the new court house at Monticello, as per plans and specifications prepared by R. H. Hunt, architect, Chattanooga, Tenn.

PORT GIBSON, MISS.—The purchase of one 250-hp water-tube boiler for the municipal electric light and water plant within the next four months is contemplated. H. D. Brownlee is superintendent.

CLAYTON, MO.—The Western Pwr. & Lt. Co., recently organized by H. C. Garneau, F. R. Mott and Joseph Dixon, Jr., of St. Louis, Mo., proposes to install an electric plant in Clayton and supply electricity in Clayton, Wellston and Ferguson, Mo.

HOPKINS, MO.—The business men of Hopkins have asked the Lee El. Co., of Clarinda, Ia., to submit estimates of the cost of extending its line from Bedford, Ia., to Hopkins, a distance of 10 miles, to supply electricity here.

MARYVILLE, MO.—Plans are being considered by the business men for the installation of an ornamental street-lighting system on Main Street.

ST. CHARLES, MO.—The St. Charles El. Lt. & Pwr. Co. has purchased a 75-kw Westinghouse generator belted to an Ideal engine. W. G. Ghiselin is manager.

BILLINGS, MONT.—Bids will be received at the office of the supervising architect, Treasury Department, Washington D. C., until Jan. 23, for construction, including plumbing, gas piping, heating apparatus, electric conduit and wiring and lighting fixtures, of the United States post office at Billings, Mont. Drawings and specifications may be obtained at the above office or from the custodian of site at Billings, Mont. Oscar Wenderoth is supervising architect.

WORDEN, MONT.—The Farmers' Tel. Co., recently incorporated with a capital stock of $10,000, will erect its telephone system entirely in the rural districts.

TECUMSEH, NEB.—Edwin Bartels has applied to the Village Board for a franchise to operate an electric-light plant in Tecumseh.

AUSTIN, NEV.—The Austin Nevada Consol. Mining Co. will install a power plant. H. G. Richardson is president of the company.

CARSON CITY, NEV.—Electric equipment will be installed in the North Carson Mine and a transmission line erected from Carson City. Mr. Symmes has charge of the mine.

EAST ELY, NEV.—The Ely Lt. & Pwr. Co. contemplates some changes to its lighting system within the next year, but has not decided what will be done; will probably purchase about 50 electric irons during the coming season.

EXETER, N. H.—The Exeter Ry. & Ltg. Co. has petitioned the Public Service Commission for approval of an issue of $25,000 in capital stock.

EXETER, N. H.—The Exeter & Hampton El. Co. has applied to the Public Service Commissioner for approval of an issue of $25,000 in capital stock.

BRIDGETON, N. J.—The Board of Public Utility Commissioners has granted the Bridgeton El. Co. permission to issue $75,000 in bonds to the American Rys. Co., the proceeds to be used for extensions and improvements to its plant and system in Bridgeton.

DOVER, N. J.—The Board of Water Commissioners has requested the Eastern Pennsylvania Pwr. Co. to submit two bids for two electric triplex pumps of 300 gal. capacity per minute and one electrically driven centrifugal pump of 75 gal. per minute for the city water-works system. The Council has authorized the board to enter into a contract with the company for electrical energy for pumping at a rate of 2 cents per 1000 gal.

HADDONFIELD, N. J.—Leading citizens and borough officials are considering the question of establishing a municipal electric-light plant.

LIVINGSTON, N. J.—Bids will be received by the Board of Education until Dec. 30 for construction, complete, including heating, ventilating and electrical work, of a new public school building, plans and specifications for which were prepared by Ernest E. Twist, architect, Passaic. S. B. Winans is clerk of board of education.

MANASQUAN, N. J.—A committee, consisting of Councilmen Moore, Thorp and Curtis, has been appointed by Mayor William F. Lefferson to ascertain the cost of installing a lighting plant for Manasquan Borough.

TRENTON, N. J.—The Board of Public Utility Commissioners has approved of a bond issue of $139,000 by the South Jersey Gas, El. & Trac. Co., the proceeds to be used for extensions to its plant and system.

BATAVIA, N. Y.—The Public Service Commission, Second District, has authorized the Genesee Lt. & Pwr. Co. to execute a mortgage on its property to secure an issue in bonds to the amount of $750,000, of which $47,000 is to be issued at once to cover the expense of new construction, etc.

CASTLETON, N. Y.—The Schodack Lt. & Pwr. Co., of Castleton, has applied to the Public Service Commission for authority to take over the local electric-light plant now operated by L. M. Lansing; also for permission to issue $7,000 in capital stock.

DEPOSIT, N. Y.—The Deposit El. Co. expects to purchase within the next six months one 250-kva, 2300-volt, 60-cycle, three-phase, 200 r.p.m. generator and exciter and one generator panel for switchboard. The company has purchased a new lighting system for Hancock, consisting of six 350-cp, 19 200-cp and 36 32-cp street series Mazda lamps with shades and goosenecks. John D. Mickle is secretary and manager.

FRANKLINVILLE, N. Y.—The Ontario Knife Co. contemplates the installation of a power plant, to cost about $25,000. The company at present purchases power, heat and light from the Empire El. Co., of Franklinville.

LOCKPORT, N. Y.—The Board of Aldermen has decided to authorize the installation of 80 additional arc lamps, 10 to be placed in each ward, to be ready for service by Jan. 1.

NORWICH, N. Y.—The Norwich Gas & El. Co. is securing the right-of-way for the erection of a transmission line from Norwich to Oxford via the towpath of the old canal. On completion of the new line electricity for operating the Oxford system will be transmitted from Norwich and the local plant will be closed down. The company will also supply electricity to residents along the line between the two towns. When the new system is completed a 24-hour service will be established in Oxford.

GASTONIA, N. C.—Bonds to the amount of $2,500 have been voted for extensions to the municipal electric-light system.

HAMLET, N. C.—The Yadkin River Pwr. Co., of Rockingham, is installing a series incandescent street-lighting system in Hamlet, consisting of 77 lamps of 32 cp. L. H. Couch is superintendent.

DEVILS LAKE, N. D.—The power plant at the Fort Totten Indian School was destroyed by fire on Nov. 27. It is proposed to construct a temporary plant so that the school work can be continued. The boilers are intact and can be used for a time, at least until new equipment is installed. C. Zeibach is superintendent.

AKRON, OHIO.—The Public Service Commission has granted the Northern Ohio Trac. & Lt. Co. permission to increase its capital stock by $2,000,000.

ALLIANCE, OHIO.—The Alliance Gas & Pwr. Co. expects to erect within the next 12 months an engine room of concrete and steel and to purchase within the next six months one 1000-kw turbine and to enlarge switchboard to meet requirements. Material for distributing system will be purchased as required. W. J. Rose is general manager.

ARCHBOLD, OHIO.—The Archbold El. Lt. & Pwr. Co. expects to install within the next four weeks a storage battery to take care of day load. The company has discarded its steam plant and is using oil engines, and may add another engine in the near future to provide for its increasing business. R. S. Rodenhuis is manager.

CLEVELAND, OHIO.—The Public Service Commission has authorized the Caxton Pwr. Co., of Cleveland, to issue $1,000 in capital stock, the proceeds to be used for organization purposes. The company was organized for the purpose of furnishing electricity for lamps and motors and steam in the city of Cleveland.

CLEVELAND, OHIO.—Sealed proposals will be received at the office of W. H. Kirby, secretary of the director of public service, until Dec. 26 for copper wire for the Municipal Electric Light Department of the city of Cleveland, in accordance with specifications which may be obtained in the office of the engineer of construction, Room 319, City Hall. W. J. Springborn is director of public service.

DELTA, OHIO.—The capital stock of the Cass County Home Tel. Co. has been increased from $150,185 to $200,085.

KINGSVILLE, OHIO.—The Conneaut, Kingsville & Ashtabula Ry. Co. has purchased property north of Kingsville upon which it proposes to erect a new power house in the near future. W. H. Hawley is president.

LORAIN, OHIO.—The George E. Milligan Co., which recently took over the lighting plants in this city, has closed a contract with the Cleveland Stone Co. to supply energy to the amount of 1500 hp at its quarries in South Amherst. A substation will be erected at South Amherst at a cost of between $8,000 and $9,000, and electricity will be supplied to various quarries operated near the village. The Milligan company will erect a transmission line from Lorain as well as from the substation to the quarries.

NELSONVILLE, OHIO.—The managers of the municipal electric-light plant expect to purchase within the next 12 months a carload of poles, some underground conduit, distributing cable, some meters and supplies for extension; also transformers, incandescent lamps, posts for cluster lamps, etc.; also two large electrically driven turbine pumps for water-works. C. C. Sharp is director of public service.

TOLEDO, OHIO.—Plans have been submitted to the City Council for lighting the Cherry Street Bridge. The plans provide for the erection of 58 arc lamps on ornamental standards, at annual cost of $2,610. If plans are adopted, the Toledo Ry. & Lt. Co. will erect and maintain the lamps.

YORKVILLE, OHIO.—The contract for installing an electric-light plant in the new hotel in Yorkville has been awarded to the Blumenthal Elec. Co. The proposed plant will have sufficient output to furnish electricity to the nearby residences as well as the hotel.

INGERSOLL, OKLA.—Preparations are being made for the installation of an ornamental street-lighting system for which bonds to the amount of $5,000 have been authorized. Bids will soon be asked for the work. B. F. Blue is town clerk.

OKLAHOMA CITY, OKLA.—The Chamber of Commerce has in hand a plan providing for an ornamental street-lighting system in the district bounded by the Santa Fé Railroad tracks, Hudson Avenue, Reno Avenue and Second Street, also extending north on Broadway from Second Street to Broadway Circle. The proposed plan calls for the erection of 591 posts, allowing from 10 to 14 posts to each square in the district. The plan has the approval of the city officials, who have agreed to bear 20 per cent of the cost of installation, maintenance and lighting, the other 80 per cent. to be borne by the property owners. It is expected that the plan will be carried out.

ASHLAND, ORE.—A special election will be held to vote on the proposition to issue $25,000 in bonds for the installation of a lighting system in Ashland.

CLINE FALLS, ORE.—George Jacobs, of Portland, has purchased the power site of the Crook County Wtr., Lt. & Pwr. Co. in Cline Falls and will erect a transmission line from the falls to Prineville, a distance of about 20 miles. A hydroelectric power plant will be erected here in the near future.

INDEPENDENCE, ORE.—A stock company has been organized by the American bottom-land farmers for the purpose of erecting a telephone system in the vicinity of Independence. The proposed line will extend south from Independence 8 miles.

MADRAS, ORE.—The City Council has granted the Cove Pwr. Co. a franchise to erect and maintain electric transmission lines within the city limits.

NEWBERG, ORE.—The Yamhill El. Co. expects to purchase within the next three months a 500-kw generator and turbine and condensing apparatus, three exciters for above and switchboard panel. C. J. Edwards is manager.

PORTLAND, ORE.—The Multnomah Central Ry. Co. is planning to extend its electric railway from Sandy to Cherryville, Ore., for which right-of-way is now being secured.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Jan. 30, 1913, for furnishing material and equipment for the Cristobal-Balboa transmission line, including steel track-span bridges, copper wire, insulators, ground plates and equipment for substations. Blanks and general information relating to this circular (No. 752) may be obtained from this office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing agent.

EASTON, PA.—The Easton & Washington Trac. Co. is said to have announced plans for extending its railway from Port Murray to Hackettstown, N. J., a distance of about 10 miles.

MARCUS HOOK, PA.—The Beacon Lt. Co., of Chester, has purchased a site in Marcus Hook, on which it proposes to erect a large substation.

MOUNT PLEASANT, PA.—Edward H. Wise, of Wheeling, W. Va., representing the Mountain Pwr. Co., of West Virginia, has applied to the Borough Council for a 25-year franchise to install and operate an electric-light system in Mount Pleasant.

PITTSBURGH, PA.—Notice has been filed with the State Department announcing the consolidation of the Monongahela Lt. Co. and the Oakmont and Verona Lt., Ht. & Pwr. Co. under the name of the Duquesne Lt. Co., of Pittsburgh, with a capital stock of $541,000. The officers are: M. B. Starring, of New York, N. Y., president; C. S. Mitchell, of Pittsburgh, controller; J. G. Splane, J. S. Weller, J. J. Heard and R. T. Rossell, directors, all of Pittsburgh.

SHARON, PA.—The Borough Council has rejected the proposition of the Shenango Valley El. Lt. Co. to furnish street lamps at $48 each per year. The Council has decided to build a municipal electric-light plant, at a cost of $85,000, and has instructed Sidney Miller, engineer, of Pittsburgh, to secure estimates of cost of same.

STOYESTOWN, PA.—The light, heat and power companies of Beaverdale, Listie and Jenners have been merged with the United Lt., Ht. & Pwr. Co., of Stoyestown, making the combined capital stock $50,000. A transmission line is now being erected to Ferrellton, Jenner Cross Roads and Jennertown, which will give the company a total of over 30 miles of main lines. The officers of the company are: E. E. Long, president; C. E. Weigle, vice-president; Valentine Muller, secretary; Calvin Fulton, treasurer, and Herman W. Berkey, general manager.

PASCOAG, R. I.—The Blackstone Valley Gas & El. Co., of Woonsocket, has submitted a proposition to the taxpayers of the Pascoag Fire District, offering to supply electricity in Pascoag for street and commercial lighting. A committee has been appointed to confer with the company in relation to the matter. The same committee will also investigate the municipal electric-light plant and report as to the probable cost of rebuilding the plant.

PROVIDENCE, R. I.—The Narragansett El. Ltg. Co. has been granted a permit for the erection of an addition to its power plant, 80 ft. by 164 ft., five stories high, on South Street. It is proposed to install a large steam turbine which will practically double the output of the plant. The boiler house will also be enlarged. Arthur B. Lisle is general manager.

WESTERLY, R. I.—The Westerly Lt. & Pwr. Co. expects to install at the Norwich & Westerly Trac. Company's substation at White Rock in the town of Stonington, within the next four months, one 400-kva frequency changer; this to be purchased for the traction company. The Westerly company also expects to purchase within the next four months one or two panels for its power station. At present the company is erecting a pole line to Bradford, 5 miles distant, and is planning to extend its lines to Weekapaugh in the near future. The Mystic Pwr. Co., controlled by the Westerly Lt. & Pwr. Co., expects to extend its pole lines to Old Mystic, Conn. M. H. Spellman is manager.

SPARTANBURG, S. C.—The Spartanburg Ry., Gas & El. Co. contemplates the construction of a new power plant near Spartanburg.

RAPID CITY, S. D.—The Dakota Pwr. Co. expects to purchase within the next four weeks 30,000-volt switching and meter apparatus for feeder line. W. R. Putnam is general manager.

MEMPHIS, TENN.—The West Tennessee Trac. Co. has completed surveys and secured right-of-way and will begin work about Jan. 1 on construction of its proposed electric railway between Memphis and Arlington, a distance of about 25 miles. B. G. Sargent is vice-president and general manager. Headquarters of the company are located at the Southern Express Building, Memphis.

SOUTH PITTSBURG, TENN.—A new 100-hp engine will be installed in the local electric-light plant, owned by J. W. Adams, of Chattanooga. Mr. Adams proposes ultimately to contract with the Eastern Tennessee Pwr. Co., of Parksville, for electricity generated at the hydroelectric plant near Parksville and will construct and operate an electric railway between South Pittsburgh and Richard City.

ABILENE, TEX.—The Abilene Gas & El. Co. contemplates the erection of power house, transmission lines and the purchase of material for distributing system, including transformers, poles, lightning arresters, insulators, wire, meters, etc., within the next three months. The company contemplates the purchase of boilers within the next four months.

BAY CITY, TEX.—The Bay City Ice & Lt. Co. has opened an office and salesroom in the center of Bay City, transferring its business headquarters from the plant. Day service has been inaugurated and W. C. Duncan, local manager, is now carrying on an aggressive campaign for motor service and appliance business. The company hopes to secure the contract for furnishing electricity to pump the city water. For this purpose a 20-hp motor will be required. Plans are also under way to erect 48 five-lamp standards around the town square.

BRADY, TEX.—The City Council has purchased the water and light plant of the Brady Wtr. & Lt. Co. for $42,200, to be owned and operated by the municipality.

DENISON, TEX.—Application has been made to the City Council by J. F. Strickland, of Dallas, president of the Texas Pwr. & Lt. Co., and associates for a 30-year franchise to construct and operate an electric-light and power plant in the city. A deal has been closed whereby Mr. Strickland and associates have purchased 58 acres of land on the Oklahoma side of the Red River, just north of Denison, where it is proposed to erect a large power plant.

EL CAMPO, TEX.—The Wtr. & Lt. Co. of El Campo, W. A. Hiddleson, receiver, contemplates improvements to its system within the next two months, including entire new brickwork around boilers and rearranging burning equipment. The company would like to receive bids on poles and expects to purchase within the next 12 months miscellaneous station and distributing equipment as needed.

HOUSTON, TEX.—The Houston Ltg. & Pwr. Co. expects to erect an extension to boiler room and make changes in engine room within the next six months, contract for which will be let to local parties. The company has purchased two Babcock & Wilcox boilers, one Curtis 6250-kva turbo-alternator, one 75-kw Curtis turbo-exciter, with condensing apparatus and necessary switching equipment for above. W. H. Chapman is president and general manager.

JOURDANTON, TEX.—A combined electric-light and ice plant, creamery, ice-cream factory and bottling works will be established in Jourdanton. G. B. Smith, of San Marcos, is interested in the project.

NACOGDOCHES, TEX.—Sealed bids will be received by S. R. McKinney, secretary, until Jan. 15, 1913, for construction of an electric-light plant. The cost of the proposed plant is estimated at about $20,000.

PARIS, TEX.—The Texas Pwr. & Lt. Co. expects to purchase within the next 12 months one 150-hp to 200-hp boiler and equipment for 2 or 3 miles of pole line and 150 magnetite-arc lamps. John A. Porter is local manager.

TIMSON, TEX.—The local electric-light plant has been purchased by P. W. McKittrick, owner of the Timson Bottling Works, who will operate it in connection with his other business.

BELLOWS FALLS, VT.—A deal has been closed whereby Chace & Harriman, of Boston, Mass., who control the Connecticut River Pwr. Co., which has a hydroelectric plant on the Connecticut River at Vernon, have purchased the property of the Bellows Falls Canal Co. and the Fall Mountain El. Lt. & Pwr. Co., which owns and operates the electric light and power plant in Bellows Falls. In addition to the water privilege, with dam, etc., the purchasers secure several plots of ground and an auxiliary plant located on Saxtons River.

NEWPORT NEWS, VA.—The Common Council has adopted the report of the special light committee and has directed that a contract be prepared whereby the city will enter into agreement with the Citizens' Ry., Lt. & Pwr. Co. for a term of five years with a privilege of taking advantage of the ten-year term. The plan provides for lighting the business section with luminous-arc lamps and the residential sections with 250-watt lamps and 100-watt lamps. The cost of the proposed system for a ten-year contract will be $10,755 per year, and for a five-year contract the cost will be $11,477.

NORFOLK, VA.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 8, 1913, for a conduit and wiring system, gas piping and lighting fixtures at the United States custom house at Norfolk, Va., in accordance with drawings and specifications copies of which may be had at the above office or at the office of the custodian, Norfolk. Oscar Wenderoth is supervising architect.

RICHMOND, VA.—The Board of Aldermen has granted the Richmond & Henrico Railway a franchise to supply electricity for lamps and motors in Richmond.

WEST POINT, VA.—The People's Lt., Ht. & Pwr. Corpn. expects to purchase within the next 12 months material for lighting system, including poles, conductors, lamps, sockets, transformers, etc., for 100-lamp series incandescent street-lighting system.

KELSO, WASH.—The Washington-Oregon Corpn., of Vancouver, contemplates the erection of a transmission line on the west side of the Cowlitz River, between Kelso and Castle Rock, thereby serving the town of Lexington with electricity for lamps and motors. The line will also be extended across the river to Ostrander, making a total distance of about 15 miles.

MORTON, WASH.—The Morton El. Co., which was recently granted a franchise to furnish electrical service here, will secure electricity to operate the system from the plant of the Lake Creek Shingle Co. Broadbent & Francis are promoters of the Morton company.

SATSOP, WASH.—The County Commissioners have granted the Elma Lt. & Pwr. Co., of Elma, and the Montesano Lt. & Wtr. Co. a franchise to erect transmission lines over the country roads to the town of Satsop.

YACOLT, WASH.—The Northern Clarke County Lt. & Pwr. Co., successor to the Yacolt Lt. & Pwr. Co., contemplates the purchase of three or four small single-phase (2-hp to 15-hp) motors and also small motors; also the purchase of household labor-saving devices of all kinds. C. R. Miller is secretary.

BUCKHANNON, W. VA.—The Buckhannon Lt. & Wtr. Co. expects to purchase within the next three months one 200-kw generator, two 250-kva, 3600 r.p.m., 60-cycle, 2300-volt generators, two turbo-generators, one 1,000,000-gal. centrifugal electrically driven pump, one 16-60-hp induction motor arranged for direct connection to centrifugal pump, switching equipment for generators, etc., one constant-current transformer, one single panel, one lightning arrester, 120 plain gooseneck brackets and sockets complete. J. G. Mayfield is general manager.

CHARLESTON, W. VA.—The West Virginia Wtr. & Lt. Co., of Charleston, W. Va., has acquired the property of the Kanawha Wtr. & Lt. Co., of Charleston, and proposes to make extensions and improvements to the properties.

FAIRMONT, W. VA.—The Monongahela Valley Trac. Co. has decided upon locations for its substation between Clarksburg and Weston. One of these will be located in Interstate, another in Janelew and the third south of Weston.

CLINTONVILLE, WIS.—Plans are being considered for improvements to the municipal electric-light and water plant within the next six months, which will include the purchase of one tandem compound engine, feed-water heaters and two boilers, one boiler-feed pump and three-phase switchboard complete. George C. Stewart is superintendent.

DE PERE, WIS.—The De Pere El. Lt. & Pwr. Co. is considering the question of installing new 60-cycle, three-phase equipment in its plant. L. L. Tessier is superintendent.

FORT ATKINSON, WIS.—The Water and Light Commission expects to purchase a 150-kw to 200-kw engine-driven generating set for the municipal electric-light plant within the next 12 months. W. L. Leonard is manager.

KAUKAUNA, WIS.—John I. Beggs, president of the Wisconsin Trac., Lt., Ht. & Pwr. Co., of Appleton, Wis., has secured a 99-year lease on the new power house and water-power of the Green Bay & Mississippi Canal Co. at Kaukauna, which was built about six years ago but owing to legal complications has never been operated. Mr. Beggs proposes to put the plant in operation as soon as possible and to supply electrical service to cities in this vicinity. High-tension lines will also be erected between Appleton and Kaukauna, making the Kaukauna plant an auxiliary to the Appleton.

MILWAUKEE, WIS.—The City Council has granted the Milwaukee El. Ry. & Lt. Co. a franchise to extend its car tracks on Wells Street from Eleventh to West Water Street.

SHEBOYGAN, WIS.—The installation of an ornamental street-lighting system, to consist of approximately 60 units, is agitated. The Sheboygan Ry. & El. Co. furnishes the street-lighting service.

COQUITLAM, B. C., CAN.—The British Columbia El. Co. has been awarded a contract for supplying the roundhouse of the Canadian Ry. Co. at Coquitlam with electricity for lamps and motors.

KAMLOOPS, B. C., CAN.—The contract for construction of Barriere River dam and flume (bids for which were opened Dec. 5) has been awarded to W. Greenless, of Vancouver, B. C., for $80,290. J. J. Carment is city clerk.

NANAIMO, B. C., CAN.—The Nanaimo El. Lt., Pwr. & Htg. Co. contemplates extensive alterations and improvements to its plant.

NEW WESTMINSTER, B. C., CAN.—The Western Canada Pwr. Co. has been awarded the contract to supply power to Factory D of the Dominion Match Co. and to the British Columbia Transport Co., of Sapperton.

WINNIPEG, MAN., CAN.—Prof. L. A. Herdt has submitted a report to the Board of Control recommending the erection of a second transmission line to Point du Bois, adding two units to the plant there and enlarging the McPhillips Street substation. The entire project would cost about $700,000.

CLINTON, ONT., CAN.—The Town Council has decided to submit a by-law at the municipal election to appropriate $33,000 to purchase the property of the Clinton El. Lt. Co., to erect a transformer station and to secure power from the Ontario Hydro-Electric Power Commission at $39 per hp per year. The commission has quoted prices for furnishing service in this district, including Goderich, Clinton, Hensall and Exeter, based on 1500 hp. Goderich will use 700 hp, Clinton 400 hp and the rest will be taken by adjoining municipalities.

CORNWALL, ONT., CAN.—The Town Council has entered into an agreement with the Stormont El. Lt. & Pwr. Co. for furnishing gas and electricity for lighting the town for a period of ten years, subject to the approval of the ratepayers. Under the new contract the town is to have a greatly improved system of street lighting at a reduction of $750 per year.

HAMILTON, ONT., CAN.—The Hamilton Hydro-Electric Board has decided to order from the Ontario Hydro-Electric Power Commission another 1000 hp of electricity for local use. The present contract is for 2000 hp.

SCARBORO, ONT., CAN.—The Township Council has adopted a resolution asking for expert advice and the early installation of electrical service over the West Danforth and Kingston Road district, the energy to be furnished by the Hydro-Electric Power Commission on the same basis as that proposed in York Township. A resolution was adopted asking the Hydro-Electric Commission to take over the district and send in experts to solicit subscribers.

TORONTO, ONT., CAN.—The City Council has decided to improve the lighting system of the Queen Street subway and place cluster lamps on Victoria Street from King Street to Adelaide Street.

TORONTO, ONT., CAN.—The City Council has decided to apply to the Ontario Railway Board and the Ontario Hydro-Electric Power Commission for an order to compel all electric, telephone and telegraph companies operating under provincial charters to place all their wires underground in the downtown districts.

YORK, ONT., CAN.—The Weston Hydro-Electric Commission has notified the Township Council that it would furnish electricity for lighting the Weston Road from the southwestern boundary to Buttonwood Avenue. The lamps will be placed under the supervision of the road commissioner, and the cost for 100-watt lamps would be $12 each per year.

New Industrial Companies

THE BROWN-LEWIS RAILWAY SUPPLY COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $2,500 by Frank T. Murray, Charles W. Paltzer and Frank S. Righeimer. The company proposes to manufacture and deal in motor, tractor and trailer trucks and all steel products.

THE WILLIAM G. CAMPBELL COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $100,000 by W. G. Campbell, of Philadelphia, Pa.; H. E. Moore, of Brooklyn, N. Y., and De P. Stagg, of Hackensack, N. J. The company proposes to do a general manufacturing and selling business, forging, foundry, mechanical and electrical work.

THE DEAN ELECTRIC COMPANY, of Morristown, N. J., has been chartered with a capital stock of $50,000 to carry on an electrical and mechanical engineering business, etc. The incorporators are: W. W. Dean, H. L. Dean and E. A. Quayle, Jr., of Morristown, N. J.

THE DYNAMAGNETO COMPANY, of Augusta, Maine, has filed articles of incorporation with a capital stock of $500,000 for the purpose of manufacturing and dealing in electrical machinery, etc. I. S. Keraney, of Augusta, Maine, is president and treasurer.

THE ELECTRIC FURNACE COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000. The incorporators are: W. J. Maloney, N. P. Coffin and E. B. Davis, of Wilmington, Del.

New Incorporations

DECATUR, ILL.—The People's Co-operative Lt. Co. has been incorporated with a capital stock of $50,000 by George W. Mueller, Frank L. Suffer and James D. Johnson. The company proposes to sell electricity.

KOKOMO, IND.—The Indiana Rys. & Lt. Co. has been incorporated with a capital stock of $3,000,000. The directors are: George J. Marott, John H. Holliday, Alexander R. Holliday, Henry Kahn, Lee Hall, Thomas C. Reynolds and L. J. Kirkpatrick.

PHILLIPS, MAINE.—The Washington El. Co. has been incorporated with a capital stock of $600,000 for the purpose of owning and operating electric railways and to do a general real-estate business, farming, mining, etc. J. H. Byron is president and N. P. Noble, treasurer, both of Phillips.

HELENA, MONT.—Articles of incorporation have been filed for the Thompson Falls Pwr. Co. with a capital stock of $5,000,000. The company proposes to develop and utilize the water-power of the Clark Forks River and to transmit and distribute electricity and gas; also to carry on a general mining business as well as the purchase and sale of timber lands. The incorporators are: John D. Ryan, of Butte; John G. Morony, of Great Falls; William D. Thornton, Max Hebgen and Cornelius F. Kelly, of Butte.

SPRINGFIELD, NEB.—The Platte El. Lt. & Pwr. C. has been incorporated with a capital stock of $500,000 by W. B. Leffler, J. Stander and P. C. Stander.

Trade Publications

LIGHT REGULATOR.—The "Dim-a-Lite," by means of which five changes of light are possible, is the subject of a small eight-page illustrated folder issued by the Wirt Electric Specialty Company, Philadelphia.

TECHNICAL DATA BULLETIN.—The Delta-Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill., is distributing a thirty-two-page bulletin which contains numerous data relating to high-tension distribution.

OIL ENGINES.—Catalog C-12 of the Remington Oil Engine Company, 120 Broad Street, New York, contains thirty-four pages of illustrated descriptive material referring to stationary oil engines and outlines the method of operation.

CONNECTORS.—Dossert & Company, 242 West Forty-first Street, New York, have issued a four-page illustrated folder entitled "The Use of Dossert Connectors in Signal Work," reprinted from a recent issue of *The Signal Engineer*.

INDIRECT ILLUMINATION.—The National X-Ray Reflector Company, in recent additions to its loose-leaf literature, calls attention to so-called "semi-indirect" lighting fixtures and prints testimonial letters covering various classes of installations.

WIRE.—The Standard Underground Cable Company, Pittsburgh, Pa., has recently issued an illustrated stretcher, 6 in. long by 16.5 in. when unfolded, which starts off with the statement that over 400 miles of "Standard" wire is woven into the twenty-five stories of the new McAlpin Hotel in New York. Some of the reasons for its use in this building as well as in other prominent buildings are given.

ELECTRICAL MACHINERY.—The Arthur Jones Company, 223 South Clinton Street, Chicago, has just issued No. 13 of "Jones' Black Book of Bargains" in electrical and mechanical power equipment. This list, which supersedes all previous publications by the same company, catalogs and illustrates a large variety of new and used electrical apparatus, including generators, motors, engines, transformers, meters, instruments, etc.

VEHICLE BATTERIES.—"Instruction Book for the Operation of 'Exide' Vehicle Batteries" is the title of an eight-page leaflet which is being sent out by the Electric Storage Battery Company, Philadelphia, Pa. In a succinct manner it gives the necessary information for the owner of an electric vehicle who desires to keep his battery in good working order. These instructions cover the "Ironclad-Exide," "Exide," "Hycap-Exide" and "Thin-Exide" batteries.

HOUSEHOLD APPLIANCES.—Of four recent publications of Landers, Frary & Clark, New Britain, Conn., Bulletin No. 289 refers briefly to the general line of electrical specialties; No. 352 deals specifically with coffee percolators and coffee machines; No. 331 tells about the Thermo-cell sadiron, while a twenty-four-page booklet, "Universal Home Needs—Electric," covers coffee percolators, shaving-mugs, teapots, tea-ball samovars, chafing dishes, portable water heaters, toasters and sadirons.

GENERAL ELECTRIC BULLETINS.—Among the various bulletins that have recently been issued by the General Electric Company are the following: Bulletin No. A4039, devoted to direct-current motor-starting and speed-regulating rheostats and panels, superseding Bulletins No. 4600, 4559 and 4532 on the same subject; Bulletin No. A4034, dealing with type "W" long-life flame-arc lamps for street illumination and designed to operate on alternating-current series circuits; Bulletin No. A4004, which describes the G-E steam flow meter; Bulletin No. 4993, which describes type RI single-phase motors; Bulletin No. 4036, which deals with direct-current exciter panels for use in connection with alternating-current generator panels when for any reason speed control of exciters is desired, these panels being designed for controlling exciters of capacities ranging from 5 kw to 100 kw, and Bulletin No. A4037, which tells about isolated and small plant switchboards for use with gasoline-electric sets and for alternating and direct current, which, while designed primarily for use with the G-E gas-electric generating sets, are suitable for use in any generating units of the same rating and are intended for small lighting plants.

Business Notes

THE ADAMS-BAGNALL ELECTRIC COMPANY announces the appointment of Mr. Nelson B. Hazeltine as manager of its Philadelphia office.

THE ARMATURE AND MOTOR WORKS, 660 West Fort Street, Detroit, plans to start in business Jan. 1. Mr. J. C. Swack, twenty-two years with the Crocker-Wheeler Company as erecting engineer, will be superintendent. Mr. W. J. Hartwig, 205 Jefferson Avenue, is to be one of the officers of the new corporation.

WOODMANSEE, DAVIDSON & SESSIONS, consulting engineers of Chicago, Ill., announce that Mr. C. N. Garland has become associated with them as combustion engineer, and that after Jan. 1, 1913, in addition to their present line of work, they will be prepared for consultation on the design and operation of producer-gas and water-gas apparatus, gas-power installations, gasification of low-grade fuels and the application of gas to the various heating problems.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 10, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,046,431. ELECTRIC-LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed June 7, 1909. Shade-holder attachment.

1,046,464. METHOD OF MAKING HOMOGENEOUS MECHANICAL JUNCTURES; A. B. Herrick, New York, N. Y. App. filed June 4, 1909. Electrically welded copper rail bond.

1,046,465. ELECTRICAL SHUNT CONNECTIONS; A. H. Hoyt, Penacook, N. H. App. filed May 24, 1911. Flat-bar connection for meters, etc.

1,046,471. AUTOMATIC ELECTRIC PIANO PLAYER; L. J. Le Pontois, New Rochelle, N. Y. App. filed Aug. 3, 1908. Operator in the casing.

1,046,473. SYSTEM OF CONTROL; C. E. Lord, Milwaukee, Wis. App. filed, Nov. 30, 1910. Successive automatic switches.

1,046,499. AUTOMATIC CONTROLLING SWITCH FOR ELECTRIC CIRCUITS; G. J. Schneider, Detroit, Mich. App. filed March 6, 1911. Thermostatic switch for heaters, etc.

1,046,500. DRIVING OF SINGLE-PHASE MOTORS; K. Schnetzler, Baden, Switzerland. App. filed Feb. 11, 1910. Two motors are mechanically connected and driven from a three-phase system.

1,046,514. ELECTRICALLY HEATED HOSIERY FORM; F. M. Vogel, Pittsfield, Mass. App. filed Oct. 21, 1911. Flat-shaped.

1,046,543. THERMOSTAT; D. Beatty, Berkeley, Cal. App. filed Jan. 23, 1912. Adjustable mercury tube.

1,046,547. INCANDESCENT ELECTRIC LAMP; F. Benz, Jr., Haledon, N. J. App. filed Sept. 23, 1910. Spider support for the filament.

1,046,554. TELEPHONE RECEIVER; C. L. Chisholm, Marysville, New Brunswick, Canada. App. filed Jan. 21, 1910. Rigidly supported diaphragm.

1,046,597. SIGNAL DEVICE FOR RAILWAYS; J. and W. H. Jennings, Greenwood, Ind. App. filed Aug. 24, 1911. Cross-over signal set by the trolley wheel.

1,046,601. POLYPHASE MOTOR CASCADE DRIVING SYSTEM; C. de Kando, Budapest, Austria-Hungary. App. filed Dec. 13, 1906. Rheostat connection for induction motors.

1,046,630. ALARM ATTACHMENT FOR INCUBATORS; J. C. Munson, Pontiac, Ill. App. filed June 17, 1912. Thermostatically operated lever mechanism.

1,046,634. ELECTRICAL SIGNAL DEVICE; H. A. Parrish, Kalamazoo, Mich. App. filed Feb. 23, 1911. Automatic tripping device for trolley-block signals.

1,046,639. ELECTRIC WELDING MACHINE; R. C. Pierce, Cincinnati, Ohio. App. filed Sept. 30, 1911. Adjustable spot-welding device for boxes, etc.

1,046,677. REFLECTING ELECTRICAL LAMP; E. H. Tate, Los Angeles, Cal. App. filed April 30, 1910. External and internal reflector surfaces.

1,046,685. MAGNETIC SEPARATORS; G. Ullrich, Broken Hill, New South Wales, Australia. App. filed July 29, 1908. For ore grading.

1,046,688. MOTOR-STARTING CONTROLLER; T. Varney and C. G. Tarkington, Pittsburgh, Pa., and Chicago, Ill. App. filed May 9, 1911. Manually closed circuit interrupters with mechanical interlock.

1,046,703. RAILWAY SIGNALING SYSTEM; A. J. Wurtz, Pittsburgh, Pa. App. filed Jan. 9, 1911. Traffic-controlling relay for each block section.

1,046,705. ELECTRICAL FUSE HOLDER; H. W. Young, Chicago, Ill. App. filed April 24, 1912. Special caps for cartridge type.

1,046,708. PORTABLE RHEOSTAT FOR WELDING APPARATUS; J. M. Yount, San Francisco, Cal. App. filed June 10, 1912. A frame on wheels adapted to be lifted by a hoist.

1,046,714. TELEGRAPHY; M. O. Anthony, Englewood, N. J. App. filed June 8, 1909. Signal generating apparatus.

1,046,722. SUPPORT FOR INCANDESCENT-LAMP FILAMENTS; G. W. Beadle, East Orange, N. J. App. filed July 19, 1909. Freely movable member pasted to the filament.

1,046,724. MACHINE FOR MANUFACTURING SUPPORTS FOR INCANDESCENT-LAMP FILAMENTS; G. W. Beadle, East Orange, N. J. App. filed Nov. 22, 1909. For inserting wire anchors in the lamp stems.

1,046,743. MEANS FOR INSULATING ELECTRICAL MACHINES; W. A. Dick, Pittsburgh, Pa. App. filed Feb. 3, 1910. Commutator clamping ring insulation.

1,046,748. ELECTRIC-VEHICLE MOTOR AND MEANS FOR SUSPENDING THE SAME; G. M. Eaton, Wilkinsburg, Pa. App. filed Sept. 8, 1908. Suspended above the truck axles.

1,046,750. ELECTRIC METER; J. B. Entz, Cleveland, Ohio. App. filed March 17, 1910. A dynamometer releases a magnetic brake.

1,046,759. CONNECTING DEVICE FOR ELECTRIC CONDUCTORS; D. T. Fisher, Columbus, Ohio. App. filed Feb. 24, 1910. Inclosed connection for mines, etc.

1,046,765. ELECTRIC SIGNALING SYSTEM; C. F. Frank, New York, N. Y. App. filed Nov 1, 1911. A series of signaling devices; for instance, for electric train control.

1,046,777. ELECTRIC HEATING APPARATUS; W. S. Hadaway, Jr., East Orange, N. J. App. filed May 1, 1909. Thermostatic control for sadirons, etc.

1,046,780. CONNECTIONS BETWEEN METALLIC FILAMENTS AND FEED WIRES OF ELECTRIC INCANDESCENT LAMPS; F. Hanaman, Budapest, Austria-Hungary. App. filed May 20, 1909. Employs a metal phosphide.

1,046,782. ELECTRIC DISPATCH SYSTEM; K. Hansel, Vienna, Austria-Hungary. App. filed Feb. 2, 1907. Electrically driven letter carrier.

1,046,785. ELECTRIC INCANDESCENT LAMP; R. H. Henderson, East Orange, N. J. App. filed March 23, 1911. Filament support.

1,046,794. RAILWAY SIGNAL DEVICE; J. and W. H. Jennings, Greenwood, Ind. App. filed Aug. 24, 1911. Automatically operated by movement of a train.

1,046,796. ELECTRIC SWITCH; J. D. Johnson, Boston, Mass. App. filed Jan. 2, 1912. Rotary key snap switch with indicator.

1,046,816. ELECTRIC RESISTANCE UNIT; E. N. Lightfoot, New York, N. Y. App. filed Dec. 14, 1911. Triangular convolutions.

1,046,819. GAS FIXTURE; H. Lyon, Gloucester City, N. J. App. filed June 17, 1910. Electrically ignited inverted burner.

1,046,822. TENSION DEVICE; H. D. Madden, Bloomfield, N. J. App. filed March 23, 1911. For winding tungsten filaments, etc.

1,046,823. ELECTRICAL SWITCH CONTACT; F. R. McBerty, New Rochelle, N. Y. App. filed Feb. 27, 1908. Platinum foil with electrolytically deposited backing.

1,046,824. METHOD OF MAKING BIMETALLIC PLATES; F. R. McBerty, New Rochelle, N. Y. App. filed Feb. 27, 1908. Platinum with electrolytically deposited copper.

1,046,834. CORE STRUCTURE FOR DYNAMO-ELECTRIC MACHINES; C. B. Mills, East McKeesport, Pa. App. filed May 9, 1911. Knurled shaft and laminated core.

1,046,854. ELECTRIC SWITCH; R. L. Ramsay, Corpus Christi, Tex. App. filed Jan. 30, 1911. Swinging telegraph-line knife switch.

1,046,859. ELECTRICALLY HEATED RECEPTACLE; J. M. Roe, Sunnyside, Wash. App. filed July 17, 1912. Heater for coffee-pots, etc.

1,046,860. ELECTRICAL CIRCUIT PROTECTOR; C. A. Rolfe, Adrian, Mich. App. filed April 21, 1902. Self-restoring thermostatic circuit-breaker.

1,046,868. STRAIN INSULATOR; E. E. Schmid, New York, N. Y. App. filed Dec. 27, 1910. Interlocking saddles.

1,046,883. ELECTRIC MEASURING INSTRUMENT; H. C. Specht, Pittsburgh, Pa. App. filed Dec. 2, 1909. For accurately determining slight variations from a predetermined relatively large current.

1,046,887. ELECTRIC-HEATING DEVICE; W. Stanley, Great Barrington, Mass. App. filed May 13, 1909. The heating element is cast inside of a metal form.

1,046,888. ELECTRIC HEATER; W. Stanley, Great Barrington, Mass. App. filed May 13, 1909. A resistance conductor is cast in a wall of the receptacle.

1,046,899. PUSH SWITCH; G. B. Thomas and E. Anderson, Bridgeport, Conn. App. filed Aug. 11, 1911. Connection between the push-button and rocker.

1,046,914. NUT HOLDER; W. M. Webb, Philadelphia, Pa. App. filed April 13, 1912. Spring device for anchoring a nut in a lamp holder, etc.

1,046,918. ELECTRIC INCANDESCENT LAMP WITH BIPARTITE BULB; P. Weisse and S. Bloch, Gronau, Hanover and Charlottenburg, Germany. App. filed April 1, 1912. Special joint between the parts.

1,046,928. COMMUTATOR; C. Zenk, Wilkinsburg, Pa. App. filed May 21, 1912. Bars molded in an insulating body.

1,046,934. TRANSFORMATION OF DIRECT CURRENTS; P. Amsler, Baden, Switzerland. App. filed March 29, 1912. Mechanical coupling of motor and dynamo with special windings.

1,046,952. AUTOMATIC TELEPHONE SYSTEM; E. Blos, Schöneberg, Germany. App. filed Dec. 21, 1909. Two current impulses per digit; the selectors have only a short linear movement.

1,046,953. SPEED RESPONSIVE SWITCH; P. J. and C. D. Bodine, Chicago, Ill. App. filed Nov. 8, 1911. Centrifugal switch with arc blow-out.

1,046,968. INCANDESCENT-LAMP SOCKET; L. J. Castonguay, Bridgeport, Conn. App. filed Jan. 21, 1910. Key switch.

1,046,982. SOUND REPRODUCING AND AMPLIFYING APPARATUS; F. J. B. Coderio, Newton Center, Mass. App. filed March 18, 1912. Sounding-board diaphragm and magnet.

1,046,985. ELECTRICAL DEVICE; J. Creedon, North Philadelphia, Pa. App. filed Dec. 20, 1911. Gloves to be worn by policemen for giving shocks.

1,047,004. ELECTRIC HEATING DEVICE; J. C. Dimmick, Los Angeles, Cal. App. filed Jan. 16, 1912. A casing with heat-storage element.

1,047,045. ELECTRIC-LIGHTING DEVICE FOR MOTOR-VEHICLE LAMPS; H. D. Grinnell, New York, N. Y. App. filed March 21, 1908. Spark ignition for gas lamps.

1,047,059. INSULATOR SUPPORT FOR LINE WIRES; H. L. Hoybook, Tyler, Tex. App. filed March 14, 1912. Separable insulator and bracket.

1,047,060. ELECTRICALLY GENERATED STEAM VULCANIZER; A. C. Hulbert, Santa Rosa, Cal. App. filed Oct. 10, 1910. Readily insertable heating element.

1,047,069. SIGNALING MACHINE; A. C. Kail, United States Navy. App. filed Oct. 17, 1911. Radial arms for day and night semaphore signaling.

1,047,084. CORNER IRON FOR PANELBOARDS; H. Krantz, New York, N. Y. App. filed May 1, 1911. Sheet-metal clamp.

1,047,085. METERING PANEL; H. F. Krantz, New York, N. Y. App. filed Oct. 20, 1911. Selective switching system.

1,047,086. PANELBOARD; H. F. Krantz, New York, N. Y. App. filed Nov. 10, 1911. Switch and fuse holders and connections.

1,047,088. ELECTRIC COOKING UTENSIL; F. Kuhn, Detroit, Mich. App. filed April 5, 1911. Hot plate and guard.

1,047,105. ALARM LOCK; L. Nagy, New York, N. Y. App. filed Sept. 9, 1911. Alarm sounded upon movement of any part of the mechanism of a door lock.

1,047,110. STREET-CAR SIGNAL; A. O. Nichols, Omaha, Neb. App. filed April 2, 1909. Co-acting operators on passing cars.

1,047,120. SANITARY DEVICE FOR TELEPHONE MOUTHPIECES; G. S. Bennett, San Francisco, Cal. App. filed Jan. 16, 1911. A roll of paper for a shield.

1,047,121. SANITARY GUARD FOR TELEPHONES; G. S. Bennett, San Francisco, Cal. App. filed March 8, 1911. Protective covering automatically shifted when the desk stand is lifted.